THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXIV. No. 594.] LONDON, SEPTEMBER 29, 1874. [26TH YEAR.] Price 6d.

RAMSAY'S NEWCASTLE CANNEL COAL. Analysis—10,000 cubic feet of gas per ton of coal; 26-candle gas; 13¼ cwt. coke per ton of coal.
The London Exhibition in 1851 was lighted with gas made from Ramsay's Cannel.
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Warranted to Measure correctly, and not to vary.
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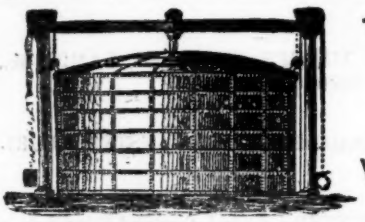

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WROUGHT AND CAST IRON SCRUBBERS, PURIFIERS, GASHOLDERS,

GOVERNORS, AND ALL THE NECESSARY FITTINGS FOR COMPLETING THE ERECTION OF GAS-WORKS.

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Warranted to measure correctly, and not to vary.

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NEW GAS-WORKS erected complete. Plans and Estimates furnished. MAINS, METERS, SERVICES, LAMPS, &c., adapted for Towns of any size. Gas Companies advised on Improvements, Extensions, and Alterations of Works.

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They beg special attention to the excellence and superiority of their WET and DRY METERS, several thousand being now in use by many of the largest Gas Companies in the West of England and South Wales. Warranted to measure correctly, and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured. A guarantee of Five years tendered with each Meter.

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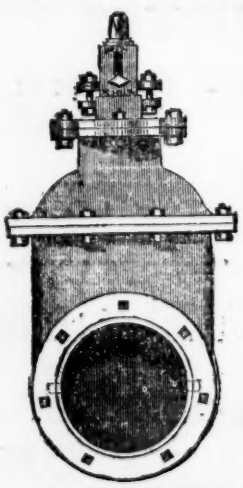
GAS ENGINEERING WORKS, COMMERCIAL ROAD, EXETER.

C. & W. WALKERS' DOUBLE-FACED GAS-VALVES.



These solidly constructed double-faced Gas-Valves are superseding the old system of the light, single-faced disc, which is too uncertain and unreliable in large bores.

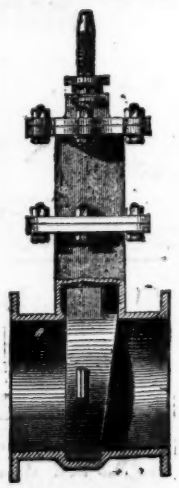
They are guaranteed absolutely gas-tight. They are very massive and rigid, and by improved modes of manufacture they are produced at very little excess in cost over the old light, weak system, which is liable to spring and bend, and become leaky.

The Valve is a rigid wedge of solid cast iron, having two perfectly scraped surfaced facings fitting between the two on the body, which are also surfaced.

A spring in two short halves, and, therefore, not liable to break, is used only for scraping the front facing clean.

The front facing is vertical; the back facing forms the wedge.

At a slight additional expense both flanges are faced to bolt to main-pipes.



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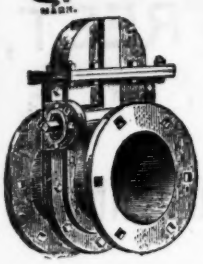
PURIFIERS, SCRUBBERS, CONDENSERS of most Improved Description.

WOOD SIEVES FOR PURIFIERS,

Which have now been in use for more than ten years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

MIDLAND IRON-WORKS, DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

B. DONKIN & CO.'S
IMPROVED GAS-VALVES



WITH WROUGHT-IRON PINIONS,

List of prices, with full dimensions of all sizes up to 48-inch, to be had on application.

These Valves are all proved on both sides to 30 lbs. on the square inch before leaving the works, and are always kept in stock.

VALVES MADE WITH OUTSIDE RACKS TO ORDER.
ALSO, SCREW WATER-VALVES WITH GUN-METAL FACES.
ALSO SOLE MAKERS OF
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COTTERILL'S PATENT STEEL TUBE-DRILLS, for connecting services to water-mains, *under pressure*, without turning off the water. They drill and tap themselves, and are left in the mains. Made of all sizes, from ¾ to 2 inches and upwards. They cost less than the ordinary plan.

Apply to CHARLES FORSTER COTTERILL, Cannock, STAFFORD, Patentee.

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SCOTSWOOD FIRE-BRICK WORKS,
NEAR
BLAYDON-ON-TYNE.

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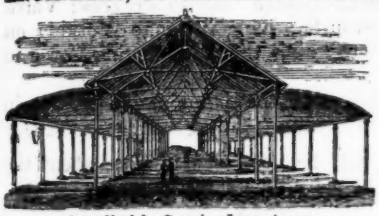
GAS-WORKS, IPSWICH,
SOLE AGENT FOR
EDGE'S PATENT
FOR REMOVING THE
CARBONACEOUS INCRUSTATION FROM GAS-RETORTS.

FRANCIS MORTON & CO., LIMITED, LIVERPOOL.
ESTABLISHED OVER A QUARTER OF A CENTURY.
ENGINEERS, GOVERNMENT CONTRACTORS, & MANUFACTURERS OF GALVANIZED CORRUGATED IRON ROOFS, BUILDINGS, AND SHEDDING,



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For which Estimates will be given on application,
ERECTED COMPLETE IN THIS COUNTRY
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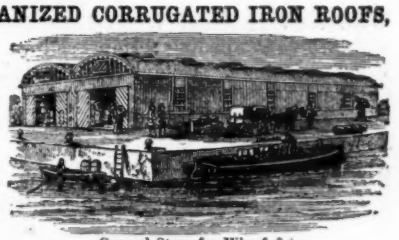
PREPARED TO PLAN FOR ERECTION ABROAD,
EITHER WITH
TIMBER FRAMING or WHOLLY in IRON.



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MANUFACTURERS OF EVERY DESCRIPTION OF
Corporate Mark SOHO Granted 1763.
STEEL TOOLS FOR GAS & WATER WORKS.
All-Steel Charging and Stoking Shovels, Coke Screens and Forks, Steel Scoops, Picks, Mattocks, Axes, Trowels, &c.
WELDING STEEL RAKE AND SPUD HEADS.
SUPERIOR CAST-STEEL FILES and SAWS; Solid Cast-Steel Hand and Sledge Hammers.
BEST CAST STEEL for making Chisels, Turning Tools, Taps and Dies, Drills, Snaps, &c.
SINGLE AND DOUBLE SHEAR, Spring, Sheet, and Blister Steel.
SILVER STEEL for Rod-Chisels and Diamond-Points for Cutting Cast-Iron Pipes, and for other work requiring a Special Quality and Temper, and every other description of Steel and Tools as supplied to the largest London Gas Companies, Contractors, and Engineers.
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CAFFALL, THOMAS, & CO., LIMITED.

PATENT IMPROVED SEAL
FOR
GAS HYDRAULIC MAINS.

SAVES COAL, RETORTS, FUEL, LABOUR, TIME, SPACE, AND CAPITAL.
PREVENTS STOPPAGE OF ASCENSION-PIPES, DEPOSITION OF CARBON IN RETORTS, THICKENING OF TAR IN HYDRAULIC MAIN.
GIVES MORE GAS PER TON OF COAL, WITH HIGHER ILLUMINATING POWER, SATISFACTION, AND PROFIT TO SHAREHOLDERS AND MANAGERS.
IS STRONG, SIMPLE, EASILY FIXED AND WORKED, AND THOROUGHLY EFFICIENT AT ALL TIMES.

TESTIMONIAL.

Gas-Works, Guildford, Sept. 15, 1874.

GENTLEMEN,—The five retorts fitted with your Patent Moveable Seal for Dip-Pipes, on June 30, have been in constant use since that date, and have worked in a most satisfactory manner.

These Retorts are still quite clean and free from carbon, whilst others not so fitted, after being at work eight weeks, required scurfing, having a deposit of carbon 2 inches in thickness on the inside.

I also find a slight increase in the yield of gas per ton of coal carbonized, although your Patent Seals are fitted to but one-fifth of the Retorts now at work.

As your statements respecting your apparatus are fully confirmed by the results obtained in practical working, I should wish you at once to fix one to each of the ovens at these works, that I may obtain all possible advantage during the coming winter.

Yours truly,
Messrs. Caffall, Thomas, and Co., Limited, 28, Gracechurch Street, E.C. Jos. SHAW, Manager.

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Lowe's Jet Photometers

(KIRKHAM AND SUGG'S IMPROVEMENTS),

With New External Water-Line Regulator; Improved Micrometer, with Quadrant divided into 45 degrees; Valve with *pro ratâ* opening; Improved Ventilator, Purple Glass Height of Flame Measurer; King's Gauge Working on Friction Rollers. Complete in French Polished Pine Case. Diagram for ditto, for finding the Illuminating Power in Candles.

Can also be had with Additional Scale on Pressure Gauge, to show by inspection the Illumination Power in Sperm Candles.

NOTE.—When an order is given for a Jet Photometer with this latter addition, it will be necessary to state about the quality of Gas for which it will be used. The range in Candles will not be more than three or four.

The New "Letheby" Photometer,

WITH DARK ROOM, &c., COMPLETE IN ITSELF.

Can be placed in any Office. Will not require a Special Dark Room. This apparatus is arranged upon an entirely New System. Is approved of as a Standard Instrument by the Standards Department, London, and adopted by the Government of Canada.

The Improved "Evans" Photometer (IMPERIAL PATTERN)

DOES NOT REQUIRE A DARK ROOM.

Fitted with all the Newest Appliances, with Sliding Glass Doors for Protecting the Apparatus from Dust. Approved of by the Metropolitan Gas Referees as a Standard Instrument.

The "EVANS" and "LETHEBY" PHOTOMETERS can be arranged for Lamps or Candles.

Standard Burners of all Kinds,

SUITABLE FOR ALL QUALITIES OF GAS.

The "London" Burner

Is adopted by the Gas Referees as the Standard for London, and is made use of in many parts of England, America, and the Continent of Europe, &c.

Sugg's Flat-Flame Burner

Is the Standard Burner adopted by the Gas Referees for Testing Cannel Gas.

UP TO THE PRESENT TIME THESE BURNERS ARE STILL UNEQUALLED.

DR. LETHEBY'S SULPHUR TEST.

GAS REFEREES SULPHUR TEST. GAS REFEREES AMMONIA TEST.

IMPROVED METER FOR GAS, with Self-acting Shut-off Cock.

GAS REFEREES SULPHURETTED HYDROGEN TEST.

PHOTOMETRICAL TABLE. Prepared by WILLIAM SUGG, A.I.C.E.

PHOTOMETERS OF ALL KINDS.

MODERN STREET LIGHTING.—Price, by Post, 1s. 7d.

GAS MANIPULATION.—A New Edition, with Improvements, brought down to the Present Time, is in progress.

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SOLE MAKERS OF

MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH

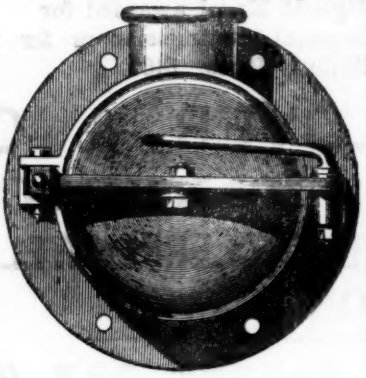
HOLMAN'S PATENT ECCENTRIC FASTENINGS & ANTI-FRICTION CATCHES.

OVER 10,000 IN USE.

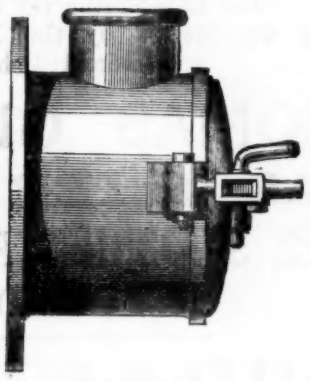
NO LUTING.

LIDS HINGED TO MOUTHPIECES; NO LIFTING ON OR OFF.

NO SCREWS FOR FASTENING.



FRONT VIEW.



SIDE VIEW.

SIMPLE.

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These Lids are proved by many eminent Gas Engineers to be the most efficient, saving much time, labour, and expense; are opened and closed as quickly and with as little trouble as an ordinary furnace door, and by their use the Retorts are soundly sealed during the whole period of carbonization.

These Lids are Adopted by the following (among many other) Gas Companies:—

The Gaslight Company, Beckton (where over 2000 are in use).	The West Ham Gas Company.	The Salford Corporation Gas-Works.	The Carmarthen Gas-Works.
„ Gaslight Company, Bow Common.	„ Imperial Gaslight Company.	„ Rochdale Corporation Gas-Works.	„ Merthyr Tydfl. Gas-Works.
„ London Gaslight Company.	„ Gas-Works, Arsenal, Woolwich.	„ Liverpool United Gas-Works.	„ Ystrad Gas-Works.
„ Independent Gaslight Company.	„ Commercial Gas Company.	„ Birkenhead Gas-Works.	„ St. Alban's Gas-Works.
„ Phœnix Gaslight Company.	„ Alliance and Dublin Gas-Works.	„ Birmingham Gas-Works.	„ Over Darwen Gas-Works.
„ South Metropolitan Gaslight Co.	„ Edinburgh Gas-Works.	„ Nottingham Gas-Works.	„ Aylesbury Gas-Works.
	„ Manchester Corporatn. Gas-Works.	„ Newcastle-on-Tyne Gas-Works.	„ Cardiff Gas-Works.

The Morton's Lid is made circular in form, that being the most convenient and suitable shape. It can be used for Retorts of any section, by adapting the Mouthpiece casting from the D, oval, or other shape, at the back, to circular in front.

The following important Testimonial has been given:—

THE GASLIGHT AND COKE COMPANY

(Commonly called the Chartered Gas Company),

BECKTON, NORTH WOOLWICH, July 2, 1874.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—In answer to your inquiry respecting the Self-Sealing Lids, I beg to say that they continue to work well, and I have every reason to be satisfied with them.

I should be very sorry to return to the old system of Luting, and our stokers here freely acknowledge the benefit to them of the new system.

I am, yours truly,

(Signed) G. C. TREWBY.

P.S.—We shall have very shortly about 3000 of your Lids in use.

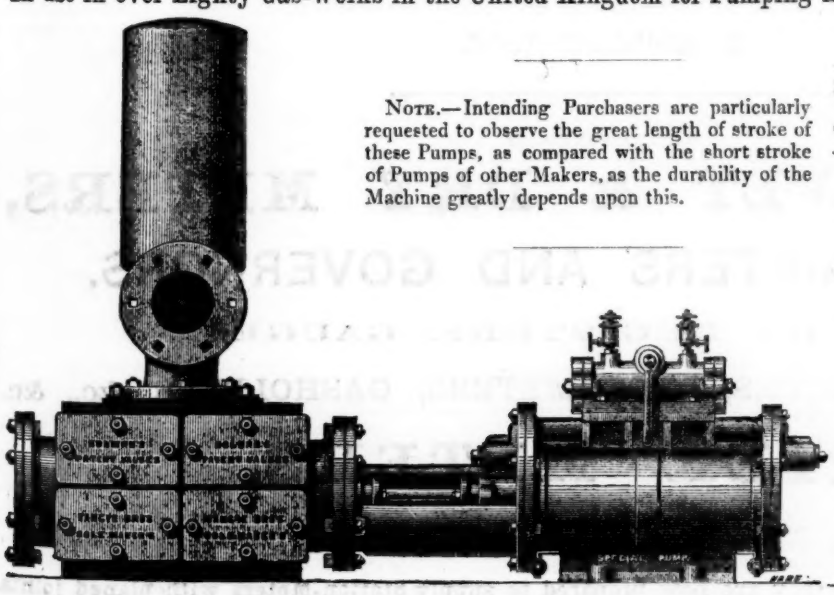
GREAT REDUCTION IN PRICES

OF

THE "SPECIAL" DIRECT-ACTING STEAM PUMPS.

Nearly 4000 have been sold since their introduction in 1867.

In use in over Eighty Gas-Works in the United Kingdom for Pumping Ammoniacal Liquor, Water, or Tar.



NOTE.—Intending Purchasers are particularly requested to observe the great length of stroke of these Pumps, as compared with the short stroke of Pumps of other Makers, as the durability of the Machine greatly depends upon this.

The following are a few of the leading Sizes:—

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons per Hour, Approximate.	Price.
3	1½	9	550	£16
4	2	9	970	18
3	3	9	2,200	18
4	3	12	2,200	20
6	3	12	2,200	25
4	4	12	3,900	25
6	4	12	3,900	30
6	5	12	6,100	35
7	5	12	6,100	40
8	5	12	6,100	45
6	6	12	8,800	40
8	6	12	8,800	50
7	7	12	11,900	50
10	7	12	11,900	65
8	8	18	15,660	65
10	8	18	15,660	75
10	9	24	19,800	80
12	9	24	19,800	110
10	10	24	24,400	100
14	10	24	24,400	140
12	12	24	35,240	140
21	12	36	35,240	285
14	14	24	47,960	180
26	14	48	47,960	450

London 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

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THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS,

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON & CO.,

(SUCCESSORS TO SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

MANUFACTURERS OF

PATENT WET & DRY METERS,

STATION-METERS AND GOVERNORS,

PRESSURE REGISTERS, GAUGES,

EXPERIMENTAL METERS, PHOTOMETERS, GASHOLDERS, &c., &c.

WATER METERS.

W. P. & Co. beg to state that they are now prepared to supply Station-Meters with planed joints.

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THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, SEPTEMBER 29, 1874.

Circular to Gas Companies.

The report of the Chartered Gas Company, which we published in our last, shows the highly favourable position in which the company find themselves after the last revision of price. The handsome balance of £34,318, which the directors can carry forward, after payment of full dividends, we may reasonably anticipate will be more than doubled in the current half year, and the sudden drop to statutory maximum prices for gas may, therefore, be looked forward to with some degree of complacency. We confess ourselves not without anxiety, having, as our readers know, hazarded an opinion that 4s. will be the normal price of gas in London for years to come. Unless some change takes place in the price of coal, of which, at the present time, we see no promise, it seems to us perfectly clear, from the accounts of the company, that gas cannot be sold at 3s. 9d. without loss. We may, however, compliment the directors on the boldness and confidence which have led them to make the announcement of the reduction, and shall await the result with intense interest.

Turning from the financial results to the manufacturing details, we find again matter on which we can heartily congratulate the management. The form of accounts now issued enables us to follow most minutely the details of manufacture and distribution; and we may here, by anticipation, express a wish that all the metropolitan companies would at once adopt the form of accounts which they will in time be compelled to publish. In the case of the Chartered Company, the account shows that the conjoined amount of common coal and cannel carbonized during the past half year was 236,581 tons, and that the gas made was 2,300,386,000 feet, which represents an average make of 9723 feet per ton. Of this quantity, no less than 8634 feet per ton were sold; and, allowance being made for consumption on works and at testing-stations, it appears that 8763 feet per ton have been accounted for. We regard this as extremely satisfactory. Our own estimate of the sale of gas per ton in 1873 was 8090 feet, a trifle over the estimate of Mr. Field; but the accounts, as now published, indicate that our calculation was below the truth. By the enlargement of mains now in progress, and the admirable plan of laying service-pipes in wooden troughs filled up with pitch, we have no doubt the amount of "unaccounted-for" gas will be still further diminished. It is now, however, seen to be a trifle under 10 per cent.

The accounts of the South Metropolitan Company are necessarily published in the same form as those of the above-mentioned company, and so afford some means of comparison. Dealing with the manufacturing results first, we find that the make of gas per ton of coal (with an extremely small per centage of cannel) was 9919 feet. It must be remembered that we are now speaking of 15-candle gas, and in the previous case of gas varying from 17 to 23 candles. The gas sold by the South Metropolitan Company, it appears, has been 9427 feet per ton of coal; and the whole quantity accounted for is no less than 9515 feet per ton. We cannot help regarding this as an extraordinary result, reflecting the greatest credit on the management.

The financial results of the half year's working are by no means so satisfactory. The net profits are only £11,430, and the sum required for dividend is for this half year £17,500. A balance of unappropriated profits, of course, supplies the deficiency, and, in this case, leaves the reserve-fund intact. The directors attribute the diminished income to a falling off in the price of coke in connexion with the continued high price of coal. But coke produced in the half year just about one-third the cost of coal, and looking over a large number of accounts for past years, we find that only about two-fifths of the cost of coal can in general be relied upon. It is with much regret that we come to the conclusion that, before long, the South Metropolitan Company may find it necessary to raise the price of gas. So far as can be seen at present, that unappropriated balance must be a continually diminishing quantity, and will be gradually extinguished. We are sorry to say that we see at present no prospect of gas at 3s., unless with coke at such a price as a severe winter may justify, producing a full dividend even for the South Metropolitan Company. The directors will, however, no doubt sacrifice their balance, rather than the *prestige* which now attaches to them as supplying the cheapest gas in the metropolitan district.

The accounts of the Phœnix Company afford the chairman the opportunity of explaining once more that the profits, as they stand, are made out of residuals. These have produced in the half year £38,483, and the net profit is £34,812. The sum required for dividend is £38,025, hence a draw has to be made on the reserve-fund to the extent of £3213. If this be the result of a half year's working at 4s. 6d. per 1000; it may be confidently anticipated the current half year at 4s. 2d. will be more unfavourable. It is impossible to criticize the accounts of the company as presented in these half-yearly returns, and we must pass them over until we get the yearly return supplied to the Board of Trade.

A correspondence has taken place between the Phœnix Company and the Lewisham Board of Works relating to the proceedings on the sulphur excess, which we not long ago reported. As soon as the proceedings were taken the company demonstrated their ability to comply with the terms of the Act of 1860, by reducing the sulphur below the statutory maximum. Then turn up the "eccentric" or "unaccountable" variations of which Mr. Patterson has made so much, and the assertion is made that to eliminate sulphur with certainty would necessitate a costly rearrangement of plant, and the creation of a terrible nuisance in Greenwich. The company are reported to have fortified their position by sending statements by Dr. Odling and Messrs. Keates and Wills, on the reading of which a most irreverent gentleman on the Board—apparently a professional man—but one evidently devoid of the smallest respect for responsible professional opinion, expressed his belief, that "chemists would say anything if they "were paid for it." Such an observation calls for no remark from us.

The report of the directors of the Alliance and Dublin Company indicates that the company are slowly recovering from the disastrous condition into which they were thrown by past legislation and careless management. The absolute loss on the last half year's working is only £705, whereas that of the previous half year was £9424. It is clear that the directors are exerting themselves to the utmost to get the company into a prosperous condition. They report a saving of nearly £5000 in working expenses for the half year, and a decrease in the quantity of coal carbonized during the half year of 8964 tons, the rental remaining nearly equal. As we have the accounts in the Board of Trade form, we are able to estimate that the sale

of gas per ton of coal has been in round numbers 7000 feet. This, it must be acknowledged, is a great improvement, and augurs well for the future. Coke has, of course, been the great difficulty. It brought only £9669 on an expenditure of £70,263 on coal, and the stock on hand is estimated at the value of only £4128. We shall have occasion to look at these accounts again after the meeting on the 30th inst.; but we may to-day heartily congratulate the directors and shareholders on the greatly improved condition of affairs.

A striking contrast is presented in the accounts of the two Birmingham Gas Companies. Last week we published the report of the older company, which showed the financial results of the half year's working to be fairly satisfactory, a net profit of £8941 having been made. We print to-day the report of the much larger undertaking, the Birmingham and Staffordshire Company, which—it must have been to the surprise of everybody concerned—exhibits a profit of only £1262. The directors, of course, have to complain of dear coal and a bad sale for coke, but something more would seem to be required to explain what a shareholder rightly called "the disastrous state of affairs." An increase in working expenses and disorganization at the works no doubt account for something, but not all. The very able manager of the works, Mr. Young, has, it seems, broken down under the pressure of work, and now a permanent Works Committee of the directors have been appointed to do what ought to be done by every board of directors—viz., to make a weekly examination of the working results. Since the profit, as stated above, is only £1262, and the sum required for full dividends is £27,426, the difference of £26,163 has to be taken from the reserve-fund which the company are so fortunate as to possess.

The accounts of the two companies have naturally attracted the attention of the Town Council of Birmingham. It was represented to the council by the mayor that the annual profits of the companies were £95,290. But Alderman Sadler, by doubling the profits for the past half year, makes out that the gain for the this year will be only £20,408; thus showing a deficit between the anticipated income and the income actually realized of £74,881, which deficiency, he says, must have been made good out of the improvement rate, had the works been in the hands of the Corporation. The worthy alderman suggests that measures should be taken with a view to rescind the agreement entered into between the Corporation and the companies for the purchase of the undertakings. The companies must, of course, be consulted on this matter, and they will no doubt insist on the bargain being carried out. The present is a purely exceptional state of affairs, and ought not to interrupt the course of the proceedings agreed upon.

We mentioned, a fortnight ago, that there was some talk of the purchase of the gas-works at Gainsborough by the Local Board of Health. The ratepayers were consulted on the matter, and they, at a public meeting, appointed a committee to confer with the Local Board. The result of the conference was that the Board decided to abandon the negotiations, leaving the onus of rejection to rest with the ratepayers committee.

Water and Sanitary Notes.

THE pneumatic sewage system of Captain Liernur, which we lately noticed was proposed for adoption at Southampton, has found a powerful advocate in Sir Philip Rose, who has, of course, the opportunity of expressing his views in the columns of *The Times*. Sir Philip is moved to a consideration of the matter by the enormous waste of water involved in our water-closet and sewerage arrangements, and by, as he shows, the great increase in the death-rate from "sewer gas diseases" since 1847. He plainly intimates his opinion that privies and cesspools are much less dangerous to health than closets and sewers, and the figures he quotes, from the Registrar-General's returns, seem strongly to support his belief. A sanitary doctor might, perhaps, draw some different conclusions from the figures, but there can be no doubt they prove that sewers are not an unmixed blessing. We have before expressed an opinion that some of our northern towns present a good field for a trial of the Liernur system, and we should be glad to see some Town Council proceeding like the Corporation of Leyden, and introducing the system in small districts, gradually extending the area as the plan was found to work. If a profit can be made by the collection of fœcal matter, as it is carried on in Rochdale, surely a larger gain may be expected from the adoption of the Liernur system. We are glad to see that it is to receive a limited application at Norwich, and no doubt it will command a larger share of attention now that it has secured the powerful advocacy of Sir Philip Rose.

Water is still very scarce in Newcastle, and the company have been compelled to further lessen the supply. Water is now furnished to the higher districts from six a.m. to noon, and to the lower districts from noon to six p.m. The directors fear that they may be obliged to shut off completely the supply for trade purposes. A scheme, it seems, has been projected for supplying Newcastle from Ulswater Lake; that would be a very expensive undertaking for the town. The extension of the company's works promises a solution of the difficulty.

The water-works management of the Hull Corporation has utterly collapsed. It is really the old story of delegating the management of a business to a committee of gentlemen who have no knowledge of it, and who have but a remote interest in its success. It happens, fortunately, that all Corporation committees are not so blind as those at Hull, and therefore we have few breakdowns of this kind to report. The engineer of the works has been summarily dismissed, and we quite coincide in the opinion of a local contemporary, that the Water Committee who have so grossly neglected their duty should be called upon to resign.

The well sunk by the Corporation of Truro yields no water at a depth of 62 feet, and the work has now been stopped. We fancy that in time the Corporation will repent of their opposition to the water company, for Truro is likely to be without a supply for a long time to come.

The differences in the value of sewage are most striking. At one place we read that a Local Board is paid £600 for the sewage of 8000 people. At another place, Longton, a borough with a population of over 19,000, the Town Council are about to pay the Duke of Sutherland £500 a year to take the sewage off their hands, the council to carry the sewage to the boundary of the borough, and the duke then to take it to his land. The works will cost the council £27,000. How much the duke will have to lay out does not appear.

Major Tulloch seems to be a man who holds definite opinions. Sitting, the other day, at Aston, the Local Board of which are under injunction to keep their sewage out of that part of the river Tame belonging to the Birmingham Water-Works Company, and who are, therefore, wishful to borrow money for the construction of works to carry the sewage farther away, the major is reported to have spoken strongly in favour of the water-closet system and irrigation. He instanced the sanitary success of water-closets as demonstrated in London, "one of the healthiest "places in the world." We have mentioned above that Sir Philip Rose attributes an enormous increase in certain diseases to closets and sewers, the simple fact being that the death-rate of London has been practically stationary for the last 40 years, and in that respect, in the metropolis, not a trace of the influence of sewers and closets, beneficial or otherwise, can be discerned. It may interest local authorities to know that Major Tulloch is disposed to allow 60 years for the repayment of loans. This certainly relieves one generation, but saddles the expense upon another, who may, possibly, have arrived at the conclusion that the money has been wastefully expended.

The Corporation of Glasgow having agreed to guarantee the expenses of a Royal Commission to inquire into the pollution of the Clyde and the means of purification, we may anticipate shortly the appointment of a commission by the Government. We shall be able to guess the general tenor of the report as soon as we see the names of the commissioners.

The Lea Conservancy Board have determined to take the case of Tottenham in hand; but, feeling themselves powerless, they have resorted to the Local Government Board for assistance. The result, we expect, will be the promotion of a Bill next year by the Conservancy Board, which will practically repeal that clause in the Tottenham Act which allows the Local Board to send their sewage into the Lea, after precipitation by the best-known practicable process.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

XXXII.

THE CONDENSER.

The idea of the construction of Wright's condenser was derived from one erected by Mr. Kirkham at the Pancras station of the Imperial Gas Company, in which the outer condensing-pipes were 36 inches in diameter, and were connected together at the top and bottom, so that the gas, in its passage, ascended and descended alternately. In Wright's vessel, however, it always descended the larger pipes, and ascended the smaller, by which method, it was believed the gas would be more readily condensed. In Kirkham's condenser a door was provided at the bottom of each condensing-pipe, which could be closed in cold weather, and thus, in some degree, the effective power of the apparatus was controlled. This form of condenser was simplified by Warner, who divided the annular space between the large and concentric pipes, vertically into two equal parts, leaving an opening at the top for the passage of the gas. By this means the upper connexions employed by Kirkham were dis-

pensed with, and the gas followed the same course as in Wright's condenser.

Horizontal air condensers have also been extensively used by different engineers, who have adopted their respective views as to construction, diameter and length of pipes, &c. By some, the condensing-pipes have been placed around the exterior of the retort-house, whilst others have adopted the opposite plan, and placed them in the interior; others, again, have combined the two systems. With such diversity of opinion on the matter, we are led to conclude that the functions of the condenser were at one time but indifferently understood.

One of the best forms of horizontal condenser was described in the JOURNAL last year, by Mr. Graham, of Stalybridge, which, it appears, works highly satisfactorily, and has been adopted by several gas companies. This condenser consists of ten rows of 16-inch pipes, each row being 65 feet long, and representing, with the inlet and outlet pipes and bends, a condensing surface of about 4000 superficial feet. The pipes are mounted on frames, and placed as close as practicable in contact with each other, having ample fall, so that the condensed liquids may flow freely. The objects attained by this kind of condenser are that the gas is gradually cooled, and the tar held in contact with the gas for a very considerable time, so removing a portion of the sulphur compounds; and, according to Mr. Graham, the average strength of the liquor produced therefrom is about 6½° Twaddel, and from his experiments he calculates that he removes by this apparatus about 16 lbs. of sulphuretted hydrogen and 5 lbs. of carbonic acid for every ton of coal carbonized.

Mr. G. Livesey, of the South Metropolitan works, it appears, has used this form of condenser for seven or eight years, the only difference between his and Mr. Graham's apparatus being that he uses common, or U-shaped bends at the ends, instead of T's, the pipes having no framing to support them, but being placed simply tier above tier, with iron or oak blocks between them. Speaking of the principle and its operation, Mr. Livesey says: "I look upon it as simply an extension of the plan of carrying a main round the retort-house; it is a more complete development of the principle of gradually cooling the gas in contact with the tar and liquor, and of not separating the latter until the whole have been brought down to the lowest temperature required, which system, fully carried out, not only increases the strength of the condenser liquor, but relieves the purifiers, by removing a considerable proportion of the carbonic acid and sulphuretted hydrogen, and reduces the tendency to deposit naphthaline in the mains and services."

Amongst the most novel and interesting contrivances for the purpose of condensing the objectionable vapours of gas is the method patented by Messrs. Pélouze and Audouin—both names honourably associated with the science of gas lighting—which differs entirely from any hitherto mentioned. It had been known for many years that the friction of the gas in passing through pipes, or that produced by the exhauster, assisted materially in the deposit of the tarry matters; but no practical advantage had ever been taken of the circumstances prior to the invention referred to. As an engraving and description of the apparatus have recently appeared in the JOURNAL, only a brief account thereof will be here given.

The condenser, as described by the patentees, consists of a cylindrical vessel, placed in a vertical position, and divided horizontally by a number of discs perforated with holes about one quarter of an inch in diameter, or, instead of this, the patentees propose slots of about the width mentioned, and two inches in length. These perforated discs are represented as being placed in sets of three, the space between each of them being about half an inch, and so arranged that the gas, in passing the orifices of one of the discs, is caused to impinge upon the solid surface of the next. Eight of such series are represented, so that the gas has to traverse 24 of these discs, and by the action of the apparatus the vapours of tar and ammoniacal liquor are condensed, unite and form small globules, and these combining form streams which flow to the bottom of the vessel (the gas entering from above), and thus the tar and ammoniacal liquor are eliminated.

For the more perfect operation, the gas was conveyed from this condenser to another of the form of a gasholder, having very small holes therein, and controlled according to the production by a governor to which it was attached.

The patentees also propose to surround the cylindrical vessel with water, the temperature of which can be controlled according to the production of gas or the nature of the surrounding atmosphere. We have not had the advantage of witnessing the operation of this kind of condenser, and are therefore unable to give our personal experience on the subject, but report speaks very favourably of it, and it may be regarded as a beautiful scientific instrument. More recently the same gentlemen have patented the means of injecting water, in the state of mist or spray, into a vessel through which the gas passes before entering the condenser. A description and drawing of the apparatus thus employed will be found elsewhere.

A correspondent of the JOURNAL about the beginning of this year described a "novel arrangement of condenser" which he had adopted. It consisted in an arrangement for passing the gas through a rectangular tinned iron frame of about 18 inches square, divided by two sheets of wire gauze placed an inch apart, and through which the gas was caused to pass and deposit its vapours. In reference to this system he says: "The gas, in passing through a large condenser, was found to be still charged with a considerable amount of tarry vapour, but on leaving the wire gauze it seemed to be perfectly free from any appearance of tar."

The principle of this apparatus is identical with that of Messrs. Pélouze and Audouin, the wire gauze replacing the perforated plates. The favourable description of the results obtained by its use only confirms the opinion generally entertained of the efficiency of Messrs. Pélouze and Audouin's invention, and it is to be regretted that our correspondent was not earlier in the field, so that he might have profited by his ingenuity.

Having briefly described the various kinds of condensers which have been employed by different engineers, we will now offer a few observations on the nature of coal gas, so far as regards the question under consideration.

A simple gas is understood to be a permanently elastic fluid, under all the ordinary conditions of temperature and pressure, but in this respect coal gas differs very materially, being, as it is, a compound of true gases with variable quantities of the vapours of hydrocarbons. These latter constitute the illuminating ingredients of coal gas, and any diminution of them, either by condensation or otherwise, is detrimental to the gas as an illuminating agent.

The hydrocarbons—these rich constituents of coal gas—are susceptible of being condensed and reduced into a liquid state at ordinary temperatures of the atmosphere, and, when exposed to a temperature below 50°, this condensation becomes very considerable, and once thus condensed, the resulting liquid is rapidly absorbed by the tar with which it is in contact, and the gas impoverished accordingly. The evil effects of this are made apparent on taking down a gasholder after it has been in operation for some years, when its tank will be found to contain a quantity of oily matter arising solely from the cause just mentioned.

To illustrate the condensation of the hydrocarbons by the influence of cold, let us take an ordinary glass retort, such as is used in the chemical laboratory, and connect the supply-pipe with its beak, and the outlet with the stopper part. If the retort be then placed in a basin or dish, and surrounded with ice, and the gas be allowed to pass therethrough, in a short time some of its hydrocarbons will be deposited in minute crystals on the surface of the retort, the gas being impoverished in direct proportion to the amount of the deposit. By this means, with protracted operations, the carbon vapours may be in great part extracted from the gas, leaving only the hydrogen and marsh gas, which, as illuminating agents, are practically useless.

This experiment is more striking when applied to "air gas," or a combination of hydrogen with the vapours of petroleum, in which case the latter are entirely separated.

The fact of this deposit of carbon vapours at low temperatures, and its injurious influence, being acknowledged, it is evident that the temperature of gas should never be permitted to attain a low degree; and we are, moreover, taught by these experiments that, in all cold climates—as in some parts of Russia, Norway, &c.—the gasholders should be enclosed within suitable buildings, and the mains laid at a greater depth than in more genial climes, in order to prevent the deterioration of the gas by the abstraction of its richest ingredients.

At the ordinary temperatures of the atmosphere, tar has a strong affinity for bisulphide of carbon and other compounds; hence it is desirable to employ it for the purpose of removing these impurities. For this object the gas should be kept in contact with the tar as long as possible, by having the condensing-pipes of considerable length, and employing means to keep them at a moderate temperature; for, if this be too high, the purifying power of the tar is diminished, and if it be too low, the hydrocarbons are deposed and absorbed by the tar.

Another reason for observing moderate temperature in the condensation is that in proportion as the liquid in the scrubber is increased in temperature above, so are its absorptive powers for ammonia unimpaired, and on it attaining 120° Fahr. the action almost ceases. Thus, in hot weather, under like conditions of quality and quantity of coal used, and quantity of gas manufactured, the strength of the ammoniacal liquor will be considerably lower than in very cold weather, a variation of 2° Twaddel being occasioned by the change of temperature.

On account of the great irregularity in the production of gas, together with the variable influences of most climates, perfection in condensation is very difficult to attain. However, according to our present knowledge, whether the condensing-pipes be placed, as adopted by some engineers, against the wall of the retort-house, or other buildings, in a continuous line; or whether they be placed in a similar position, but in lengths parallel to each other, or as horizontal condensers; or whether they be arranged as a series of stand-pipes, with their communicating bends, as generally practised, certain precautions are necessary in order to ensure successful operation. For example, the whole of the apparatus should be protected from the influence of the rain or intense cold, or the sun's rays; for, by the action of the two first, the condensation might be so rapid as to remove a considerable portion of the illuminating constituents of the gas, to which cause may probably be assigned the deposition of naphthaline, which is really the solidification of a hydrocarbon, and by the influence of the latter, in certain localities, that degree of radiation of heat, so essential for the removal of the objectionable vapours, could not be obtained, so that it would be necessary to cool the condensing-pipes by causing jets of water to flow on to them.

The condenser in some establishments is one of the principal ornaments of the works, and it may be objected that to make any alterations would detract from their appearance; but for successful operation this precaution should be adopted. Moreover, the thermometer should be employed in every gas-works, and attached to the outlet of the condenser, so that a record of the temperature of the gas at that point could be always kept, and should it acquire that degree of cold which would be detrimental to it, then by the application of steam to the exterior of one or more of the pipes, or at one part of the pipe (there being a jacket arranged for that purpose), the temperature necessary to retain the hydrocarbons in suspension

would be always attained, and this accomplished, the form or method of applying the condenser would not be material.

It may be argued that, supposing the vapours are prevented from condensing at this point, and supposing the weather to be severe, they would be deposited afterwards, for which apprehension there are some grounds; but under no conditions can this be so prejudicial as during the process of manufacture, for if we suppose the gas to be stored, it would be only that portion in immediate contact with the gasholder, which would be subject to the cooling influence of the atmosphere, and as on entering the holder the gas is of a comparatively high temperature, the condensing action of the atmosphere would be in some measure counteracted.

Lastly, to ensure successful condensation, the gas issuing from the outlet of the condenser should never be lower than 50° nor higher than 70° Fahr., as low temperature affects the illuminating power of the gas, and high temperature impairs the absorbtive powers of the liquid in the scrubbers, and the affinity of the tar for the sulphur compounds (sulphuretted hydrogen, in this case, not being considered). The pipes forming the condenser should be of considerable length, or other means employed, as suggested, in order to retain the gas in contact with the tar for as long a period as possible, so as to allow of the sulphur compounds being absorbed by the latter. Under ordinary circumstances, these pipes should have a superficial area of 9 or 10 feet for every 1000 cubic feet maximum production per diem, and all proper precautions should be adopted to protect the condensing-vessel against the variation of temperature, the rain, the sun's rays, and cold; and to have the means of increasing the heat of the vessel, should this be desirable.

(*To be continued.*)

Communicated Articles.

STREET-LAMPS AND METER AVERAGES.

By J. O. N. Rutter.

It is 23 years since, in this Journal, I endeavoured to show the inconsistency and injustice of the system which had then so long existed for supplying gas to street-lamps by contract. On the same occasion I offered suggestions as to the necessity and practicability of inaugurating a more equitable method for ascertaining the quantity, and fixing the price, of gas required for lighting streets. The use of meters was strongly urged; and also that the prices paid by public authorities should be a fair commercial equivalent of value according to local conditions, and the charges to private consumers.

Among the advantages which were considered certain to follow the adoption of the sale of gas to all classes of customers, on something like equitable conditions, were increased consumption and reduced prices. To those who, possessing the requisite knowledge, have kept in remembrance the principal phases of gas lighting during the last 20 years, I confidently appeal for an affirmative decision. Great as may have been the above-mentioned expectations, they have been more than realized.

Much of the right sort of work has been done, and some of it well done; but old customs are not easily to be spirited away. Long, long, after they are known and openly acknowledged to be bad, only fit to be reckoned among the useless *débris* of a former age, they are found lingering about their accustomed haunts. It must not be supposed that an improved system of charging for gas to street-lamps has become general, and that only in rural districts, and other out-of-the-way places, do former practices prevail. In largely populated cities and towns there have been, and still are going on, what may be termed hesitating movements, and as much on the part of gas companies as public authorities. A bolder policy would be more satisfactory and more beneficial to both parties.

Impressed as I was that, in these, as in many other affairs, right and wrong may be so commingled, and work so closely side by side, as to be scarcely distinguishable; yet the time would come that right would emerge from the mistiness of ignorance and misrepresentation, and be eventually understood and appreciated. How much longer shall we have to wait?

For many years, after expressing my opinions about the use of meters for street-lamps, and the necessity for an equalization of prices for all classes of consumers, I had no opportunity, under my own directions, of practically testing the proposed alterations. The most I could do was to offer advice. During this period, many tentative processes were devised. These were anything but encouraging; and no wonder, when it is remembered how unfitted they were, both theoretically and practically, to attain the object. Failures from causes easily understood, although more numerous than successes, were not without their value. In these trials of different kinds of apparatus, there were mistakes in their construction and management; but, notwithstanding the delays thereby occasioned, there was, in reality, a clear gain. Years passed away, taking with them some of the so-called impossibles and impracticables, and at last bringing to the front what had been sought for—suitable appliances in meters, regulators, and burners.

Until 1868 the contract system had been in operation in Brighton, extending over a period of 43 years. Since 1839 there have been revisions and renewals, but the terms and conditions have not been materially altered.*

It must not be imagined that in Brighton, any more than in other places, revisions of prices and renewals of contracts for supplying street-lamps have been managed with perfect unanimity. On several occasions there have been disputes, with a profuse distribution of the usual stock phrases incident to gas agitations. These are not very complimentary, and it is pleasant to know that most of them by long usage are worn out; whilst others have entirely lost their significance. Notwithstanding occasional touches of antagonism, there are no large towns in which the consumers of gas have been more fairly treated, and viewed, as it ought to be, in connexion with local circumstances, none in which gas has been charged at such moderate prices. In 1852 the price was 5s. per 1000; in 1864, 4s. 9d.; in 1865, 4s. 6d.; in 1866, 4s.; and in the same year 3s. 6d., at the last-mentioned price = 14 candles.

When the contract for street-lamps (1847) just now referred to was settled, the price to private consumers was 7s. per 1000. The public authorities were, therefore, paying less than two-fifths of the current rate. During the periods of successive reductions to private consumers, efforts were made to obtain proportionate reductions in the charge to public authorities. This was not done. It would have been impolitic as well as unjust. The minimum charge to private consumers, whatever that be, can only be reached and fairly maintained by equality of prices to all classes of consumers. This is the true commercial principle; and wherever it is violated there is wrong-doing.

One other matter requires to be noticed. It is the manner in which public authorities have been accustomed to deal with gas companies, treating with them as if their respective interests were antagonistic. This has been the means of prolonging inequalities of prices; the private consumers having had to pay something extra for the hard bargains for supplying street-lamps.

An Act obtained by the Brighton and Hove General Gas Company in 1866 virtually put an end to the supply to street-lamps by contract in Brighton and the surrounding (lighted) districts. The price of gas supplied in Brighton and Hove was fixed at 3s. 6d. per 1000 feet (14 candles) to private consumers and the local authorities. Provisions were made for establishing the system of meter averages, one meter in every 15 lamps, the rate of consumption by regulators to be 5 cubic feet per hour, and the period of lighting 4000 hours a year.

In 1868 contracts for lighting the streets and public buildings in the borough of Brighton were entered into by both gas companies; the terms and conditions being alike; based upon the provisions in the Act of 1866; and subject to a special calendar of times for lighting and putting out the public lamps.* Two-light dry meters, made specially to fit the lamp-columns by the Gas-Meter Company, Kingsland Road, were adopted by both companies. They have done their work very satisfactorily. The regulators and steatite (bat's-wing) burners, used by the Brighton Gas Company, are manufactured by Mr. W. Sugg. These merit my highest commendations.

In 1873 the Brighton and Hove General Gas Company obtained an Act empowering them to increase their charges for gas. At the instance of the Brighton Town Council, a clause was inserted by which the previously statutable yearly rate of consumption of 20,000 cubic feet in each public lamp was reduced to 15,000. Soon after the Act was in operation arrangements were made with both companies to fix 4 feet instead of 5 feet per hour burners. A new calendar was also adopted, reducing the number of hours of lighting.

Is it asked, "How has the meter average system worked?" I answer in one word, "*Well.*" We are in the sixth year. During the whole period, and from its commencement, everything has gone smoothly. There has been no hitch—no need for trying to do better, for there has not been anything to amend. There have been no complaints, no disputes, no errors to adjust.

Let no one imagine that the success of which I have spoken is to be realized without forethought and contrivance. Everything has to be done with a purpose. There must be nothing left to chance; but, just the reverse of it, there must be constant watchfulness. To suppose that regulated burners and a certain number of metered lamps constitute what is meant by meter averages, would be a most wonderful mistake. There must be vigilant inspection, or failure will be certain; and the lamplighters must be well trained and trustworthy. The frequent breakings-down of which we have heard, in attempting the new system of lighting, have originated in neglect and irregularities on the part of the men.

It is not my intention to attempt to show further the advantages of meter averages by a bewildering array of figures. No one more thoroughly believes in the power and the value of figures, when rightly placed; but mere repetitions are more showy than useful.

It will be remembered that the maximum hourly rate of consumption, under the contract of 1868, was 5·25 cubic feet. The following figures will show the averages of each of the four quarters of 1871 and 1872:—

March, 1871	.	5·064	. . . 1872	.	5·062
June, „	.	5·41	. . . „	.	5·536
Sept., „	.	5·182	. . . „	.	5·383
Dec., „	.	5·066	. . . „	.	5·063

* Since 1846 the terms and conditions have been as follow—namely, charge, £4 each lamp per annum. Bat's-wing burners, 5 cubic feet per hour, sunset to sunrise, 365 nights. Company to light, put out, clean, provide burners; the authorities to provide columns, brackets, fittings, lanterns, keep in repair, and paint. The total number of lamps divided equally between the companies, and the conditions, as above quoted, and in other respects, alike. Under the directions of the borough surveyor, a few meters were for several years attached to street-lamps. By these it was ascertained that the annual rates of consumption varied according to the prevalence of long periods of calm or stormy weather. The lowest rate was 24,300, and the highest 27,100 cubic feet. Taking 25,000 as a mean rate, under ordinary circumstances, and deducting 12s. 6d. per lamp for lighter's wages, ladders, oil, and burners, the amount paid for gas was £3 7s. 6d., or 2s. 8½d. per 1000.

* Thus—Gas, 3s. 6d.; hourly rate, 5 feet; margin allowed, ·25; excess beyond 5·25 not to be charged. Meters purchased by the Town Council, maintained by the companies. The companies servants light, put out, clean. Lanterns and fittings found and maintained by the Council. The charge for lighting, putting out, and cleaning, including the purchase of regulators and burners, and keeping them and meters in good condition, 15s. per lamp per annum.

The averages of the respective years are more conclusive of the accuracy attainable, for these are actual results of whole year's workings; thus—

1871, Dec. 31 . . . . . 5·144
1872, „ . . . . . 5·197

Under the recently-altered arrangements, with an hourly rate of consumption of 4 feet, the maximum rate being 4·25 per hour, the averages are as follow:—

March quarter, 1874 . . . . 4·278
June „ „ . . . . 4·147*

Only a very few more words. The light-producing effects, from equal quantities of gas, are greatly in favour of steatite nibs as compared with iron. When lamps are fitted with regulators, they are not so liable to be blown out in stormy weather as those without.

Some persons have been puzzled, and have made it a complaint against regulators, that the indications of metered lamps are not more uniform. The principle of meter averages is variableness in details, uniformity in results. This is attainable, as shown by the figures I have quoted. In a group of lamps—say 70, 80, or 90, as the case may be—assigned to one man, there ought to be no difficulty in perceiving that no two of the metered lamps in the group could be lighted and put out at the same instant, any more than that the same man could be in two different places at the same time. Differences in time resolve themselves into differences of consumption, and these—some less, some more—finally adjust themselves with extraordinary accuracy.

In this brief summary of some of my experiences in meter averages I am not intending to convey instruction. The introductory processes, I should hope, are now tolerably well understood. What I have in view is to encourage those who still hesitate to turn their thoughts in the right direction. I have patiently waited for a change for the better. It has come, and is still coming, but, comparatively, slowly. Why so long in doing the right thing—selling gas by measure, and receiving a fair price for what is sold?

Black Rock, Brighton, Sept. 17, 1874.

THE PRINCIPLE OF THE VALUATION OF GAS COAL.

By D. A. Graham, Stalybridge.

(*Reprinted from p.* 333.)

Application of the Formulæ, d H + c F : 100 : : c F : y, to ascertain whether the Difference of the Differences, or some other Measure, is the correct Method of Estimating the Commercial Values of Different Qualities of Coal and Cannel.

Through some unaccountable error, the concluding paragraphs of the last article were transposed, which must have resulted in a confusion of ideas. We therefore reproduce the latter portion of the paper, correcting an error which occurred in the concluding lines.

First, then, let it be ascertained what per centages of this coal and cannel will be requisite to produce, say, 18-candle gas, and what return per ton those per centages of this coal and cannel will produce?†

$$18 \begin{cases} -\ 14{\cdot}3 \\ -\ 24{\cdot}25 \end{cases} \times \begin{cases} 6{\cdot}25 \\ 3{\cdot}7 \end{cases}$$

Therefore $\frac{6{\cdot}25}{10{,}665}$ of coal + $\frac{3{\cdot}7}{10{,}875}$ of cannel will produce 18-candle gas.

The numerators of the fractions $\frac{6{\cdot}25}{10{,}665} + \frac{3{\cdot}7}{10{,}875}$ will equal 67·96 + 39·46, and their sum will equal 107·42.

∴ 107·42 : 100 : : 67·96 : x ∴ x = 63·2

36·8

100·0

∴ 63·2 × the coal producing 10,665 = 6,740·280
And 36·8 × the cannel „ 10,875 = 4,002·000

And 100·0 per cent. of the mixture will produce 10,742 cubic feet; results which exactly agree with those obtained from the measurement of the diagram.

Now, it will be remembered that we based the estimates on the assumption that the coal cost 20s. delivered, and that the cannel cost 30s. delivered, so that the mixture would cost 23s. 8d.—

63·2 × 20s. = 12·64
+ 36·8 × 30s. = 11·04

23·68 = 23s. 8d.

If, therefore, 23s. 8d. represented the value of this mixture, what would be the values of the coal and cannel used to produce the same quality of gas in the two following mixtures, the afore-mentioned coal or cannel being used as one of the quantities of these mixtures requisite to produce that particular quality of gas?

1st Example.—A coal produces 9000 cubic feet of 12·5-candle gas. What per centage of this coal would be required to manufacture 18-candle gas when used along with the cannel producing 10,875 cubic feet of 24·25-candle gas?

$$18 \begin{cases} -\ 12{\cdot}5 \\ -\ 24{\cdot}25 \end{cases} \times \begin{cases} 6{\cdot}25 \\ 5{\cdot}5 \end{cases}$$

So that a mixture of $\frac{6{\cdot}25}{9{,}000} + \frac{5{\cdot}5}{10{,}875}$ will produce 18-candle gas, and the sum of these numerators will equal 679 of coal + 495 of cannel = 1174 of both.

And 1174 : 100 : : 679 : x ∴ x = 57·8, and 100 − 57·8 per cent. of coal = 42·2 per cent. of cannel.

And 57·8 per cent. coal × 9,000 = 5202 cubic feet.
And 42·2 „ cannel × 10,875 = 4589 „

100·0 per cent. will produce 9791 cubic feet.

2nd Example.—A coal produces 10,665 cubic feet of 14·3-candle gas; and a cannel (Duke of B——r's) produces 9676 cubic feet of 20·3-candle gas. What per centages of each must be used to produce 18-candle gas, and what will be the return per ton of the sum of these per centages?

$$18 \begin{cases} -\ 14{\cdot}3 \\ -\ 20{\cdot}3 \end{cases} \times \begin{cases} 2{\cdot}3 \\ 3{\cdot}7 \end{cases}$$

And the numerators of $\frac{23}{10{,}665} + \frac{37}{9676}$ will equal 222 of coal + 394 of cannel, their sum being 616.

∴ 616 : 100 : : 394 : 64 of cannel, and 100 − 64 = 36 per cent. coal.

∴ 36 per cent. coal producing 10,665 cubic feet = 3,839 cub. ft.
And 64 „ cannel „ 9,676 „ = 6,192 „

∴ 100 per cent. will produce . . . . . 10,032 cub. ft.

Now, we have here found three separate statements, which it may be well to summarize preparatory to our drawing any deductions from them. The first is—

1. A mixture of 63·2 per cent. of a coal producing 10,665 cubic feet of 14·3-candle gas, *plus* 36·8 per cent. of a cannel producing 10,875 cubic feet of 24·25-candle gas, together produced 10,742 cubic feet of 18-candle gas, the mixture costing 23s. 8d.

2. What is the commercial value of a coal which produced 9000 cubic feet of 12·5-candle gas, when compared with the coal which cost 20s. per ton, as this value can be ascertained in a mixture of 57·8 per cent. of this coal, and 42·2 per cent. of the cannel which cost 30s., this mixture producing 9791 cubic feet of 18-candle gas?

3. A mixture of 64 per cent. of the Duke of B——r's cannel, and 36 per cent. of the coal which sold for 20s. delivered, and which produced 10,665 feet of 14·3-candle gas, together produced 10,031 cubic feet of 18-candle gas; what was this cannel worth as compared with the cannel producing 10,875 cubic feet of 24·25-candle gas?

First, then, what were the various items which constituted the aggregate value of mixture No. 1, which cost 23s. 8d.?

The cannel used for finding the value of the difference of the differences produced 10,875 cubic feet of 24·25-candle gas, 1568 lbs. of good coke, according to Mr. Longworth's analysis, quoted in Newbigging, and this is probably the slaked weight, which is, of course, the weight at which the article is sold (we weighed the *hot* coke produced from this cannel, and found that it weighed 1435 lbs., while the tar it produced weighed 200 lbs., and the ammonia liquor of a strength equal to 4° Twaddel, but which was increased to 6° in scrubbing, was equal to 65 lbs. per ton carbonized); but we shall adhere to the figures formerly quoted, when we estimated the weight of tar produced from the cannel to be equal to 201·6 lbs., and the weight of the ammonia it produced at a like amount (201·6 lbs.), which was stated to have a strength equal to 6° Twaddel.

Coal.

The coal selected for purposes of comparison was one which produced 10,665 cubic feet of 14·3-candle gas (its real quality is 14·9-candle gas, new "London" burner), and we then estimated the tar it would produce at 155 lbs., and the ammonia water, having a strength equal to 6° Twaddel, at 248 lbs., while the coke was stated to weigh 1450 lbs.

To the coal which produced 9000 cubic feet of 12·5-candle gas we formerly added on the 1½ candle for the new "London" burner; but we have taken it off here, so that we may be the better enabled to ascertain the principle from the greater divergence of qualities.

The coke it produced was stated to weigh 1427 lbs., and as neither the amount of the tar nor ammonia water it produced were stated, we estimated their weight as being proportional to the amounts produced from the coal selected as a standard of comparison, and which produced 10,665 cubic feet of 14·3-candle gas. The weight of tar would therefore be found from the following formulæ:—

$$\frac{155 \times 9}{10{,}665} = 130{\cdot}8 \text{ lbs. of tar;}$$

And the weight of the ammonia water would equal—

$$\frac{248 \times 9}{10{,}665} = 209{\cdot}3 \text{ lbs. of ammonia water.}$$

We shall now proceed to ascertain what the value, 23s. 8d., in mixture No. 1 represented.

It contained 36·8 per cent. of the cannel producing 10,875 cubic

* Since Midsummer (1874) the former prices, in Brighton and Hove, have been resumed—viz., 3s. 6d. per 1000 = 14 candles, "London" burner.

† This coal really produces 14·9-candle gas, new "London" burner. The per centages required would therefore be 32·6 per cent. of cannel + 67·4 per cent. of coal; for—

$$18 \begin{cases} -\ 24{\cdot}25 \\ -\ 14{\cdot}9 \end{cases} \times \begin{cases} 3{\cdot}1 \\ 6{\cdot}25 \end{cases}$$

And the numerators of the fractions $\frac{310}{10{,}875} + \frac{625}{10{,}665}$ = 3306·15 and 6796·87.

And 3306·15 + 6796·87 = 10,103·02,
And 10,103·02 : 100 : : 3306·15 : 32·6 per cent. of cannel;
And 32·6 per cent. of cannel × 10,875 = 3,545·25 feet,
And 67·4 „ coal × 10,665 = 7,188·21 „

10,733 feet.

feet of 24·25-candle gas, *plus* 63·2 per cent. of the coal producing 10,665 cubic feet of 14·3-candle gas, the mixture producing 10,742 cubic feet of 18-candle gas.

The tar in the mixture would weigh—

36·8	×	201·6 lbs.	=	74·26 lbs., cannel tar,
63·2	×	155·0 lbs.	=	98·96 lbs. of coal tar;

And 100 per cent. of the mixture would weigh 173·22 lbs. of coal and cannel tar.

The ammonia water of the mixture would weigh—

36·8	×	201·6 lbs.	=	74·26 lbs. of cannel ammonia,
63·2	×	248·0 lbs.	=	156·73 lbs. of coal ammonia;

So that 100 per cent. would weigh 231 lbs. of coal and cannel ammonia water.

Coke.

36·8	×	1568 lbs.	=	577·0 lbs. of cannel coke,
63·2	×	1450 lbs.	=	916·4 lbs. of coal coke;

And 100 p. c. of the mixture would produce 1493·4 lbs. of coal and cannel coke.

From which several statements we may proceed to ascertain the value of the secondary products.

We previously estimated the value of the tar at 25s. per ton, which is equal to 1s. 1¼d. per 100 lbs., or, taking the decimal value, 1·116s. per 100 lbs.

The ammonia water was valued at 15s. per ton, or 0·669 of a shilling per 100 lbs., and the coke was valued at 6d. per 100 lbs.

		s.	d.
Now 173·22 lbs. of tar, at 1·116s. per 100 lbs. = 1·93s.	..	1	11
231·0 lbs. of amm. water, at 0·669s. per 100 lbs. = 1·54s.		1	6½
And 1493·4 lbs. of coke, at 6d. per 100 lbs.		7	5½
So that		10	11

would represent the value of coke, tar, and ammonia water in this mixture, and 23s. 8d. − 10s. 11d. = 12s. 9d. would therefore represent the value of 10,742 cubic feet of 18-candle gas, which was produced from this mixture; from which data we shall proceed to estimate the values of the production of the other mixtures.

Now, mixture No. 2 produced 9791 cubic feet of 18-candle gas. What was that quantity worth as compared with mixture No. 1, which produced 10,742 cubic feet of 18-candle gas?

In a former chapter we estimated the cost of carbonizing, cost of renewals, repairs, and other expenses, at 6s. 8d. per ton, equal to 6·66s., and we then showed that these costs would be inversely as the production, when the production of one coal was compared with that of another. Therefore the relative costs of these several charges for these two mixtures would be found as follows:—

$$\frac{10{,}742 \times (6{\cdot}66,\text{ the cost of renewals, \&c.})}{9791} = 7{\cdot}306 = 7\text{s. } 3\tfrac{3}{4}\text{d.}$$

And 7s. 3¾d. − 6s. 8d. = 7¾d., which 7¾d. would represent the difference of these several costs (carbonizing, renewals, repairs, interest, &c.) for these two coals.

Now, after deducting 7¾d. from the 12s. 8d., which represented the value of the 10,742 cubic feet, the value of 9791 cubic feet would simply be proportional to the remainder.

Now, 12s. 8d. − 7¾d. = 12s. 0¼d., and the following proportional statement would therefore give the value required:—

10,742 : 9791 : : 12s. 0¼d. : 11s. 1d.

Therefore 11s. 1d. would represent the value of 9791 cubic feet of 18-candle gas.

From which we shall now proceed to estimate the values and quantities of the secondary products in the same mixture.

Tar.

42·2	per cent. of 201·6 lbs.	=	85·07 lbs. of cannel tar,
57·8	per cent. of 130·8 lbs.	=	75·60 lbs. of coal tar;
∴ 100	per cent. will produce	.	160·67 lbs. of coal and cannel tar.

Ammonia.

42·2	per cent. of 201·6 lbs.	=	85·07 lbs. of cannel ammonia water,
57·8	per cent. of 209·3 lbs.	=	120·97 lbs. of coal ammonia water;
∴ 100	per cent. will produce	.	216·04 lbs. of ammonia water.

Coke.

42·2	per cent. of 1568 lbs.	=	661·69 lbs. of cannel coke,
57·8	per cent. of 1427 lbs.	=	824·80 lbs. of coal coke;

∴ 100 p. ct. of the mixture will produce 1486·49 lbs. of coke.

		s.	d.
Now 160·67 lbs. of tar, at 1·116s. per 100 lbs. = 1·795s.	..	1	9½
216·04 lbs. of amm. water, at 0·669s. per 100 lbs. = 1·44s.		1	5
And 1486·49 lbs. of coke, at 6d. per 100 lbs. = 7·43s. ..	..	7	5
So that the secondary products of this mixture are worth		10	7½

Now the value of the gas contained in this mixture was found to be 11s. 1d., so that 11s. 1d. *plus* 10s. 7½d., the value of the secondary products, would represent the commercial value of this mixture (*the coke being valued at one uniform rate* for all these various productions); so that the value of this mixture, producing 9791 cubic feet of 18-candle gas, would equal 21s. 8½d.

But 42·2 per cent. of this mixture was composed of the same cannel which was used in a former mixture, No. 1, and which cost 30s. per ton, and 42·2 per cent. of 30s. = 12s. 8d.; so that 21s. 8½d. − 12s. 8d. = 9s. 0½d. would represent the value of the 57·8 per cent. of coal used in the mixture. If, therefore, 57·8 per cent. was worth 9s. 0½d., what would 100 per cent. be worth?

$$\frac{9\text{s. } 0\tfrac{1}{2}\text{d.} \times 100}{57{\cdot}8} = 15\text{s. } 7\tfrac{1}{4}\text{d.}$$

Which would represent the comparative value of the coal producing 9000 cubic feet of 12·5-candle gas.

How, then, does this result compare with the value we formerly obtained when we valued from the difference of the differences?

The coal which costs 20s. produced 10,665 cubic feet of 14·3-candle gas, and the difference of the carbonizing and other expenses between it and a coal producing 9000 cubic feet of 12·5-candle gas, would equal 1s. 2¾d.

And $\frac{10{,}665 \times 6{\cdot}66}{9000}$ = 7s. 10¾d., and 7s. 10¾d. − 6s. 8d. = 1s. 2¾d.

So that the coal producing 9000 cubic feet was worth 1s. 2¾d. less for carbonizing and other expenses, than the coal producing 10,665; and the difference in the values of candles by the difference of the difference method of valuation would be—

10,665	×	14·3	= 152·5 candles.
9,000	×	12·5	= 112·5 candles.
A difference of			40·0 candles.

And 40 × ·98d. the value of the differences = 3s. 3¾d. less for gas than the coal producing 10,665 cubic feet of 14·3-candle gas.

Now the valuation of the residuals for the coal producing 10,665 cubic feet of 14·3-candle gas would be—

	s.	d.
155 lbs. of tar, at 1·116s. per 100 lbs..	1	8¾
248 lbs. of ammonia, at 0·669s. per 100 lbs.	1	8
1450 lbs. of coke, at 6d. per 100 lbs.	7	3
Together, equal to a value of	10	7¾

And 20s. − 10s. 7¾d. = 9s. 4¼d. for the 10,665 cubic feet of 14·3-candle gas.

Now the value of the residuals for the coal producing 9000 cubic feet of 12·5-candle gas would be found as follows:—

	s.	d.
130·8 lbs. of tar, 1·116s. per 100 lbs.	1	5½
209·3 lbs. of ammonia, at 0·668s. per 100 lbs.	1	4¾
And 1427 lbs. of coke, at 6d. per 100 lbs.	7	1½
Together, equal to a value of	10	0

So that the coal producing 9000 cubic feet would be worth 7¾d. less for residuals, 1s. 2¾d. less for carbonizing and other expenses, and 3s. 3¼d. less for gas than the coal which produced 10,665 cubic feet, and which cost 20s., these different items together amounting to a difference of value equivalent to 5s. 1¾d., and 20s. − 5s. 1¾d. = 14s. 10¼d., which would represent the value as estimated by the difference of the differences. These two different methods of valuation showing a difference of 15s. 7¼d. − 14s. 10¼d. = a difference of 9½d.

In the one case we estimated the value of the gas at the difference of the differences (0·98d.), and $\frac{9\text{d.}}{40 \text{ candles}}$ = 0·225d., and 0·98 − 0·225 = 0·755.

Now $\frac{9\text{s. } 4\frac{1}{2}\text{d.}}{152{\cdot}5}$ = 0·74 was shown to be the value of the candle when the coal candle was valued by itself, to the exclusion of any consideration of the value of the difference of the differences; from which it would seem that a coal should be valued from the value of the standard coal candle, and that the principle of valuing from the difference of the differences would seem to lead to the absurdity, that a quantity of gas manufactured from coals inferior to the coal selected as the standard of comparison was worth nothing at all—

For 0·74 × 152·5 would equal 0·98 × x,

and the difference, 152·5 − x, would represent a quantity of candles which were either valueless, or which were to be had for nothing; but if it is remembered that poor coals are much more liable to deposit naphthaline than rich coals, raising the apparent amount of leakage to a quantity beyond its real amount, and that it is these inferior coals which are the most liable to form deposits of carbon in the ascension-pipes, and that it is commonly the inferior qualities of coals which contain large per centages of iron and other foreign matter—all of which both reduce the value of the coke manufactured, add to the difficulty of keeping the furnace-bars clean, and necessarily, we might also add, providentially, reducing the heats of the settings — then we think that there is good reason for valuing a coal candle rather from the value of the difference of the differences, than from the proportional value of the number of candles.

But we shall yet prove that neither 15s. 7¼d. nor 14s. 10¼d. represents the actual comparative value of this coal, but that it is a value less than either.

Before, however, entering upon this new view of the subject, we shall first endeavour to ascertain the comparative commercial value of the cannel used in "mixture No. 3."

(*To be continued.*)

Correspondence.

CARBONIZATION.

DEAR SIR,—Will you kindly allow me space for a few words on the damper. I notice at pp. 331–2, of the issue for Sept. 8, the writer says that, where a proper draught exists, the opening at the damper should be about 12 square inches, and if through carelessness or ignorance the damper is opened to the extent of 24 square inches, it would be simply

throwing money away. Now, if 12 square inches is correct, I have been recklessly wasting the money of the company I represent during the last six years, for I have, and am now working with my dampers out to the extent of 24 square inches, which I cannot but think is right, and in practice I find it works well with me, and gives very fair results for a small work with *no exhauster*. My coals for the last 12 months give 9509 feet per ton, and I get from 4800 to 5300 per mouthpiece, with retorts 18 in. by 18 in. by 9 feet, and the amount of fuel used is 35 per cent., but the high per centage of fuel is caused in the summer months, when there is not sufficient make to keep the retorts in full work. What has induced me to say these few words on the damper is to invite some other managers or engineers probably more able to treat with the subject than myself.

R. Good.

Carshalton Gas-Works, Surrey, Sept. 21, 1874.

THE GASLIGHT AND COKE COMPANY.

Sir,—In your article on our report appears the following:—"This justified the caution of the framers of the Act of 1868, who, while accepting a low maximum price, inserted and insisted on the revision clauses."

It would appear from this as though the companies had drafted, and were the introducers of, the measure, but such was not the case.

The framers were parish delegates, who, though absolutely hostile to the companies, yet had sufficient sense of justice to insert, without communication with us, the revision clauses which formed part of the Metropolis Gas Bill, 1868, as introduced by them.

I never saw the bill until it was printed, by order of the House, in the month of March of that year, and I then found that the clauses went so far as to require the Revision Commissioners to give the companies a price sufficient, not only for the current year's dividend of 10 per cent., but also *to make up any deficiency of their dividend in the then last preceeding year.*

In the progress of the bill through committee, the other companies having refused to submit to its provisions, its operation was limited to the Chartered, the City, and the Great Central Companies, and it became "The City of London Gas Act, 1868;" Mr. Cardwell, however (more severe upon us than even our opponents), altering the revision clauses by striking out the direction to the commissioners to make up the back dividend, and substituting an instruction to them "to make up the insurance-fund authorized by the Act" in lieu of it.

J. O. Phillips, Secretary.

Horseferry Road, Westminster, S.W., Sept. 23, 1874.

BRITISH ASSOCIATION OF GAS MANAGERS.

Sir,—I was sorry to see it suggested in "Telata's" letter last week that some members of the British Association of Gas Managers are afraid to speak at the annual meetings. If they give utterance to facts they can stand to, or suggest improvements in any part of gas apparatus, let them not fear what any one may say, as the chair is sufficiently strong to shield its members. As our association is for ventilating facts and suggestions, and receiving the opinions of others, what is chaff will go to the wind, what is good will remain.

Woe be to the day when members forego their privilege, or hesitate to declare their minds in the midst of their peers. I advise those who are diffident or afraid not to sell their birthright.

Andrew Gibb.

Oswestry Gas-Works, Sept. 26, 1874.

Legal Intelligence.

GLASGOW COURT OF SESSION.—Valuation Appeal Court.

Wednesday, Sept. 23.

(*Before Lord* Ormidale.)

ASSESSMENT OF THE GLASGOW CORPORATION GAS-WORKS.

This was a rating appeal, the Dean of Faculty and Mr. Balfour appearing for the appellants, the Glasgow Corporation, who are the owners of the gas-works; the Solicitor-General and Mr. Harper for the valuator, Mr. Dods, and the city of Glasgow parish; and Mr. Burnet for the barony and Govan parishes, respondents. The appeal was against a valuation of £60,848 which had been put upon the gas-works, and the grounds of appeal were that the valuator had made no deduction for tenants profits on the sum estimated as capital necessary for the tenant to carry on business. Last year the works were valued at £28,600. Appearance was entered in the case by the City Parish, Barony, and Govan Parochial Boards, who to get a *locus standi* appealed against the valuation on the ground that it was too low, the amount stated by them being £70,000.

Mr. Balfour, for the appellants, said that in previous years Mr. Dods had made a deduction in respect of tenants profits, but proceeding upon a decision given in the Court of Queen's Bench—*Mersey Dock Commissioners v. The Liverpool Poor Law Overseers*—which he thought to be applicable to this case, he had altered the principle of valuation. The sum, Mr. Balfour contended, that must be arrived at in a case of this kind was that for which the subject would let one year with another. Different modes had been adopted for arriving at what might be called a hypothetical rent, but the method which had recently been followed seemed to be one consistent with sound principle. It was to take as a factor on which the work was to be begun the gross receipts of the undertaking, then to deduct from that, in the first place, all that required to be paid out, such as material and wages, in order to bring in that money. In the present case there was no question as to the cost of production, because deductions had been made in respect of wages, &c. After making these deductions, however, there remained a sum of money, and if the subject were letable, the question was what sum of it would be divided into the landlord's share and the tenant's share. In the cases of the Inverurie, Renton, and Leven Gas Companies, decided last year, the principle of deducting tenants profits was adopted, and unless there was some good ground for distinguishing the present case from those mentioned, that must be the method the valuator should follow. Mr. Dods, according to the principle he had now adopted, started with the gross receipts, £325,000 odd, and, making all proper deductions, arrived first at £78,000; then he gave 5 per cent. on the value of the meters, &c. Afterwards he deducted £16,000, and that left £60,000 odd, but he did not allow one penny for tenants profits. The appellants maintained that the valuator should have allowed 17½ per cent. for tenants profits. It had been said that this gas corporation had such a constitution that it was legally impossible for it to make profits; and that a deduction could not therefore be made on the assessments. That, however, was at variance with the explicit declaration of the statute, which said that the value of the subject should be what it would let for one year with another. The mere fact of the subject having such a constitution that it could not be let did not take off the obligation of ascertaining and fixing a hypothetical value. The case decided against the Mersey Docks on the 19th of November, 1873, was the case Mr. Dods founded upon, but he (Mr. Balfour) contended that there was an important distinction between the two cases. In the case of the Mersey Docks nobody was to make a profit from the rates levied; while in the present case, under section 86 of the Corporation Act, it was declared that they should "carry any balance thereof to the credit of the corporation for general purposes." There might, therefore, be a profit; and if profit was legally possible, there was an important distinction between the two cases.

The Solicitor-General, for the respondents, contended that the corporation were carrying on the concern as representatives of the public, and not with a view of making profit. It was true that under the 86th section of their Act power was given to carry forward any balance for general purposes; but his learned friend did not venture to represent that that was a general licence to the Corporation of Glasgow to make a sum of money to supplement annually the other estimates. The whole spirit of the Act entirely supported the view that the corporation were bound to make their calculations as to the price of gas in order to meet their annual expenditure, so as to close their accounts at the end of the year with a balance due to neither side. In the case of the Gas Corporation, there were no tenants profits to deduct because there were none to charge.

The court took time to consider its judgment.

KETTERING COUNTY COURT.—Wednesday, Sept. 16.

(*Before* R. Harrington, *Esq., Judge.*)

KETTERING GASLIGHT AND COKE COMPANY *v.* NIVEN.

This case had been several times before the court. In the last instance it was in an action brought by a large number of persons who carry on business in partnership under the provisions of a deed of settlement, dated in 1838, by the style of the Kettering Gas Company, against the defendant, their previous manager, in trover or detinue to recover the value of certain plans prepared by the defendant for them whilst in their service. The plaintiffs, by the name of the Kettering Gas Company, commenced a similar action against the defendant, which came on for trial in May last. The objection was then taken by the defendant's counsel, that the plaintiff's company was unregistered under any of the Joint-Stock Companies Acts, and therefore could not sue in its corporate capacity. This objection was admitted by the plaintiffs to be fatal, and they submitted to a nonsuit. Instead, however, of registering themselves under the Joint-Stock Companies Act, 1862, 25 & 26 Vict., cap. 89, sec. 210, the plaintiffs immediately brought a fresh action, in the names of each individual member of their company, against the defendant, for the same cause. This action came on to be tried at the June court before a learned judge of another county court circuit, who sat on that occasion in this court, and the objection was then taken that the company was a company required by the 25 & 26 Vict., cap. 89, sec. 209, to register, and that being unregistered, they were, under sec. 210 rendered incapable of maintaining any action. The plaintiffs were again nonsuited. They thereupon, still remaining unregistered, brought a third action for the same cause against the defendant, which came on to be tried before Mr. Harrington in July, when a learned counsel appeared for the defendant, and again took the same objection which had been successful at the June court. Considering the great importance of this question to the plaintiffs, the learned judge thought it right to hear the case on the merits, reserving the judgment of the court upon the objection taken to the plaintiffs' capacity to sue, although, upon the merits, the court was fully satisfied of the justice of the plaintiffs claim.

In now delivering judgment, his Honour stated the facts at some length, as already reported in the Journal, No. 585, page 122, and then referred to the various statutes incorporating and regulating the proceedings of joint-stock companies. The two questions, he said, that he had to consider were—1. Was this a company required by 25 & 26 Vict., c. 89, s. 209, to be registered? 2. If it was, did the disabling clause in section 210 extend to prohibit the individual members of the company from suing during non-registration for an injury done to them in their collective capacity? Having regard to the general course of legislation in this matter, which seemed to have been uniformly directed to compel the registration of all trading companies not subject to the jurisdiction of the Stannaries, or privileged by charter, letters patent, or private Act of Parliament; to the fact that this was a company required under the doubly repealed 19 & 20 Vict., c. 47, s. 3, to be registered under one of the Joint-Stock Companies Acts, and to the effect produced by the disability to sue if confined to the company in its corporate capacity, he should, if unassisted by authority, have come to the conclusion that this company, as long as it continued unregistered, was disqualified from suing in the name of its individual members. But he was concluded by the authority of *Womersley v. Merritt*, cited by the plaintiff's counsel, in which case both points were decided the other way. It was not for him, in this inferior court, to question, but only to follow that decision, which must be questioned, if at all, in a Court of Appeal. He might, however, without impropriety, call attention to the fact that the mind of the learned Vice-Chancellor who decided that case did not appear to have been directed to the circumstance that the hardship referred to by him in his judgment only existed during the wilful contumacy of the defaulting company, and that under section 210 they lost no vested right, but only had their remedy suspended until they conformed to the law. There would, therefore, be judgment for the plaintiffs for the amount at which he assessed the damages at the time, £41—*i.e.*, £1 for the value of the plans, and £40 for detention.

Mr. Henry, who was for the plaintiffs, produced a letter received from the defendant, in which he stated that he would return the plans and specifications if the company would thus settle it; if not, they must take their own course with regard to the expenses, as he had but little work, and all his ready money had been expended in defending the action. An execution had been issued, but the bailiff returned that the goods had been transferred to a relative. He therefore asked for a judgment summons against him, which was granted.

CHESTERFIELD POLICE COURT.—Thursday, Sept. 24.

(*Before the Mayor, Mr.* T. P. Wood, *and Mr.* Hewitt.)

BREAKING A STREET-LAMP.

James Watson, a tramp, was charged with doing malicious injury to a public lamp, the property of the Chesterfield Gas and Water Company, the damage amounting to 1s. 6d.

Mr. Jones, manager of the company, appeared to watch the case for the prosecution.

A policeman said that he was at the station on the evening in question when he heard some one smashing glass, and on going out he saw the prisoner, who said he had broken the lamp over the door. He also said that he was under the impression that he had been matched for £25 to throw at a ball placed at the top of the iron post, and he mistook the lamp for it.

Prisoner was fined 10s. and costs, and in default was committed for seven days.

A Market Town without Gas.—Under this heading we published a paragraph from a local paper in the Journal of the 15th inst. It seems now that the inhabitants of Wetherby, which was the town referred to, have at length seen the seriousness of dark streets. The other evening the ratepayers held a meeting, at which a resolution was passed empowering the gas inspectors to light the streets with oil until such time as they can be supplied with gas. It was also decided to hold a meeting shortly to consider the advisability of applying to Government to place the town under the Local Government Act. It was mentioned that the town is unprovided with a fire-engine, and that in case of fire one could only be obtained from a considerable distance.

Miscellaneous News.

BIRMINGHAM AND STAFFORDSHIRE GAS COMPANY.

The Half-Yearly General Meeting of Shareholders was held on Tuesday, Sept. 22—Mr. W. SHARP in the chair.

The CHAIRMAN, in introducing the business, said he felt sorry that he could not greet the shareholders with the same degree of satisfaction on the present as on some previous occasions, owing to the fact that the board were not able to lay before them so satisfactory a balance-sheet as they might fairly have expected. Although the directors were thereby deprived of the pleasure of congratulating themselves upon their success during the last half year, there was not only nothing to apprehend, but everything to hope for. It was true that a few clouds had passed over the concern, but they were only passing clouds, and now they had a clear sky before them. Above and beyond the pleasing fact that they were able to give the shareholders their dividend in full, the directors had the fullest assurance with regard to the future, so that they hoped that what had been experienced in the past would be resumed in the future, and that their business, rather than being worse, would be better, even for the present vicissitude. The contracts they had entered into for coals had been, as the directors thought, most favourable, and at very reduced prices; there was a probability, almost a certainty, that their coke trade would be very much better; and as they anticipated an improvement in trade, the consumption of their gas would also greatly increase. With these things before them they believed there was nothing to despair, but everything to be hopeful of. The reading of the report might create misgivings in the minds of many of them as to the causes of their want of success, and questions might be floating which they were anxious to put. The directors had resolved to be candid with them, and would have pleasure in answering any questions put to them.

The following report and statement of accounts were submitted, and their adoption moved by the CHAIRMAN:—

In laying before the proprietors the balance-sheet for the half year ending the 30th of June last, your directors deeply regret being obliged to report so unsatisfactory a result. The balance of profit is £1262 17s. 1d. only. The causes which have mainly led to this unfortunate result are the high price of coal—the full force of which has fallen on the past half year, and the insufficient prices obtained for coke, attributable to the depressed state of trade in the iron district. Your directors have further had to contend with unprecedented difficulties in connexion with the labour employed in the works. Your directors recommend that the usual dividends be paid upon both classes of shares. The sum required for this purpose is £27,426 5s. To pay this amount it will be necessary to draw upon the reserve-fund to the extent of £26,163 7s. 11d. They recommend that the dividend be paid on the 29th inst. Your directors look forward with confidence to more satisfactory results in the future. Coal is already reduced in price. An improved state of trade will ensure a better market for the coke, added to which arrangements are in contemplation, having for their object improved facilities in disposing of the coke. The Act of Parliament for carrying out the sale of the company's undertaking to the Corporation of Birmingham will be applied for in the next session. The directors who retire by rotation at this meeting are Mr. Howard Luckcock and Mr. Henry Rotton, and, being eligible, they offer themselves for re-election. Mr. Young having resigned his situation as engineer to the company, your directors have appointed him consulting engineer.

Dr. *Profit and Loss Account, June 30, 1874.* *Cr.*

Coals	£114,296	11	2	Balance brought from last half year's account	£23,270	5	7
Purifying materials and process	1,650	16	10	Amount taken from reserve-fund	3,218	9	5
Repairs and maintenance of meters, mains, service-pipes, and other works	12,537	10	11	Sale of gas, after deducting £6000 for estimated discounts and bad debts	101,896	17	0
Wages	13,306	6	5	Coke and breeze	40,981	1	3
Lamps (providing, lighting, extinguishing, cleaning, and repairing)	1,333	14	1	Tar and other residuals, and fittings	15,195	13	5
Rates and taxes	4,917	18	2	Rents	54	9	8
Salaries, collectors commission, and payments to directors	5,836	11	3				
Interest on loans	1,489	14	9				
Professional charges and incidental expenses	1,024	15	4				
Dividends paid to proprietors—viz., 10 per cent. per annum on £320,400. Capital raised under Act of 8 & 9 Vict., cap. 66	16,020	0	0				
Seven and a half per cent. per annum on £275,000 for six months, & £12,500 for two months, raised under Act of 21 Vict., cap. 1	10,468	15	0				
Miscellaneous	451	5	4				
Balance carried to next half year's account	1,262	17	1				
	£184,616	16	4		£184,616	16	4

Mr. H. WIGGIN, in seconding the motion, said that the board regretted, as he was sure the shareholders did, that they had to present for the half year an unfortunate balance-sheet. There was no doubt that all of them were anxious to know something of the cause, and the directors were most willing to give them every explanation. He would himself endeavour to explain some of the causes which had led to their present position. For many years past that had been a most prosperous concern, and up to the last 12 or 18 months they had year by year not only made their maximum dividend, but something more, which they had added to their reserve-fund, till it was as nearly full as they could make it. Fortunate it was that they had that reserve-fund to fall back upon now. During the last two years there had been a very great crisis, not only in the coal trade, but also in the labour market. It was impossible to carry on a large concern like that from hand to mouth. They had undertaken a great responsibility—that of lighting the town of Birmingham and a large portion of South Staffordshire; therefore they were obliged to look forward and make large contracts. As they were all aware, when they had to buy in a rising market, such as there was 18 months ago, there was sure to be a loss when the reaction came. Now that, to a very large extent, had been their case. They had to buy coal at a very high price; and, unfortunately, at a time when they ought to be getting a correspondingly high price for their coke, a strike took place in South Staffordshire. The strike lasted for 17 weeks, and their market for coke was closed to them. They had no means of disposing of their coke, and they had for many weeks to burn it under their retorts instead of slack, which in ordinary times they could buy at a low price. They knew this was suicidal, but it was a thing that could not be helped. Then there was another thing. Their engineer, Mr. Young, who had stood by the company and faithfully served its interests for years and years, like many other people, had got older. As long as things were going on smoothly Mr. Young was a perfect glutton at work. He undertook everything. The directors frequently suggested to him that he should turn over some department to other persons; but he undertook too much, and when this crisis came he was unequal to the pressure. The men at their works, as at many others, were in a state of disorganization. The shareholders would recollect the trial of the three gas stokers. It produced a very bad effect upon the stokers of all gas companies, and sometimes the directors had reports that 25 or 30 firemen were absent, and they were not in a position in which they dared to discharge them, for, had they done so, a strike would have followed. Now, however, they had turned over a new leaf, and if any man did not do his duty the orders were to discharge him at once. They could do that now, but they could not do it 12 months ago. The manner in which the men neglected their duty was also a very serious thing, for, instead of producing from a ton of coal 9000 or 10,000 cubic feet of gas, it frequently happened that they only produced 8000. The directors at the time were helpless with these men, and were obliged to submit. He might tell them, however, that when the sheets of accounts came to be made out, the directors were as surprised as the shareholders. They knew it would be a bad half year, but they had no idea it would be so bad. A Works Committee was formed, and any one who had gone through one thing after another, as they had, would agree with the chairman that the clouds had passed away. They knew what they were doing. They felt that Mr. Young, however able he had been, had undertaken too much, and they had appointed him consulting engineer, leaving the management of the works in younger hands. The committee sat permanently, and had the managers continually before them. They had returns of everything made to them. They had advertised for a person to dispose of their coke, and they were doing everything that could possibly be done. They regretted that the result of the half year had been so disastrous, but he was sure shareholders would have done as the directors had done under the same circumstances. When a concern had been making maximum dividends from year to year he would never interfere with the management. The moment they found anything wrong, they looked at it from one end to the other; and Mr. Young, having undertaken more to do than he was able, stepped on one side for a younger and more active man. Things were much more closely looked after than they were some months ago. These considerations, to his mind, accounted almost, if not entirely, for the small amount of profit that had been made during the past year.

Mr. COLLIS: How is it that you have made about 12 times as little profit as the Birmingham Company, who had to work with the same disadvantages? I think it is a strange thing that the Birmingham Company have made a profit of £8000 to £9000 and you have not.

Mr. WIGGIN: I think what I have stated is a sufficient answer to your question.

Mr. MARLOW said that in the report of the 31st of December, 1872, 18 months ago, the directors stated that notwithstanding the continued increase in the cost of labour and coal and other materials used in the production of gas, they could congratulate the shareholders on the satisfactory state of the accounts, which showed an available balance of £32,808 4s. That was the state of things in December, 1872, as reported to the shareholders in March, 1873. Now, in making a comparison of the accounts that were submitted to them at the last meeting with those now submitted, he found on the profit and loss account that there was an increased expenditure on the following items:—In wages there was an increased expenditure for the half year of £717, and in salaries, collectors commission, and payment to the directors, of £1118 10s 3d., making an increased cost in pure working expenses of £1835. There was an increase in the cost of repairs amounting to £904 5s. 3d., and in rates and taxes of £324 1s. 8d., making together £1228 6s. 11d., which might be called outgoings on property. Then there was an increase in the interest on loans (which he assumed to be from the additional money borrowed, and not increased rate of interest) amounting to £348 14s. 6d. The dividend on increased capital came to £937 10s., so that the payments on what might be called interest on the capital account were £1286 4s. 6d. more during the half year than they were during the preceding term, which made a total increased expenditure of £4350 6s. 7d. On the other hand, there had been a decreased expenditure on the following accounts:—Coal account, £76 6s. 2d. less than in the preceding half year; purifying materials, £922 16s. 1d. less. He did not know whether or not the latter decrease was such a difference as might be expected in the ordinary course, but it seemed a large amount. Then there was a decrease in lamps of £146 15s. 2d.; in professional charges and incidental expenses of £148 13s. 10d.; and in miscellaneous of £27 18s. 5d., making a total decrease of £1322 9s. 8d. Deduct this amount from the excess of expenditure before pointed out, £4350 6s. 7d., and the net excess would be £2927 16s. 11d. If they took from that excess the items which were in respect of increased capital—namely, interest on loans and increased dividend—it left as the increased expenditure on the half year £1641 12s. 5d. only. This was as between the half year ending December, 1873, and the half year ending June, 1874. But when he looked on the other side of the account, there had been a decrease in the receipts arising on the following items:—On the sale of gas the receipts were £6005 7s. 2d. less than in the preceding half year, and this notwithstanding the increased price which they charged. There had been a decrease in the sale of coke and breeze amounting to £12,940 0s. 2d. Against this there was a set off of increase from the sale of tar, other residual products, and fittings, amounting to £323 14s. 7d., making a net decrease of £18,621 12s. 9d. in the production from the works. It would be more satisfactory if in future accounts the receipts for residuals and for fittings were set down separately in the printed accounts. The decrease in the receipts which he had mentioned of £18,621 12s. 9d. had gone on during the half year, whilst at the same time the capital account showed £40,762 2s. 7d. less due to the company in respect of gas, other products and fittings, and £4033 10s. 1d. less of residual products and other stock in hand. The rents were £295 8s. 10d. less than in the preceding half year, but this was an item which might easily vary. Then he found that the capital of the company had been increased during the half year by payments on additional capital to the extent of £25,000; by calls prepaid, £5174 17s. 4d.; and by loans, £800; making an increase of the capital by £30,974, whilst the reserve-fund had been reduced by £3677 1s. 5d., and the balance of cash by £22,007 8s. 6d., making a total of £56,658 9s. 11d. This might be easily accounted for in this way: the amount owing by the company had been reduced by a sum of £38,046 4s. 9d., and the cash with the treasurer increased by £18,807 5s. 8d. He presumed that the whole of the reserve-fund was not invested, and that accounted for the difference. They would also find, by looking at the balance-sheet, that the property of the company had been reduced by £32,621 17s. 2d., though £30,974 had been received on that account during the half year. He would not say there was anything rotten, but there was something wrong, in the state of Denmark, and he should be happy to receive an explanation. The increase in the working expenses and in the purchase of materials was a mere trifle. There was a considerable decrease in the sale of coke and residuals, but that did not account entirely for the deficiency. He did not wish to make any motion on the statements he had made, but would leave them with the directors.

Mr. WIGGIN said it would have been more fair if Mr. Marlow had compared the half year just past with the corresponding half of 1873, and not with the preceding half year.

Mr. MARLOW explained that the reason he had not done so was that he had not a copy of accounts for the corresponding half year until that morning, when there was not sufficient time for him to examine the figures.

The CHAIRMAN said Mr. Marlow's remarks were an analysis of figures with which the directors were familiar. They did not dispute them. There might be some figures that could be explained; but to explain them all would occupy a very long time.

Mr. Z. WALKER pointed out that in June, 1871, the amount of their loans was £13,235. In the report presented for the half year ending June, 1871, the directors stated that it was their intention to pay off the amount; but instead of so doing they had gone on increasing it up to the present time, when it stood at £62,775, an increase of nearly £50,000, besides the increase of their capital by the calling up of the £28 shares. In June, 1873, their reserve was £63,275,

but now, after drawing upon it for their dividend, it would only amount to about £20,000, representing a loss of nearly 7 per cent. on the amount of their called-up capital. It was certainly a disastrous state of affairs. It was dead loss. He trusted it was the last time they would hear anything further of this drawing upon the reserve-fund. A state of accounts leaving a balance of only £1262, he characterized as worse than disastrous. Supposing they did not have this great increase of trade which the directors were flattering themselves with, he did not see where they were to get it from; and what would they do supposing they were in the same lamentable position on December 31, as they were on June 30? The amount of cash required to pay the dividend would be about £30,000, of which they could find in the reserve-fund £20,500, the whole of which would go. The chairman had said other companies had been in a very sad plight. He (the speaker) had taken from a responsible guide 23 of the important gas companies in this country, and he found that out of the 23 no less than 18 were paying 10 per cent.

The CHAIRMAN added that some of the London companies had permission to raise their price of gas, or they would have had to draw more largely on their reserve-funds.

Mr. WALKER said, in his opinion, the accounts should not only show the amount spent for coal, but the tonnage of the coal should be given, so that the shareholders might know whether they were paying a fair price.

Mr. R. P. WALKER said he objected to their present deficiency being called a passing cloud. The probability was their concern would be transferred to the corporation, in which event their deficiency would never be made up, but remain a dead loss.

Mr. WIGGIN: It is a great misfortune, no doubt.

Mr. WALKER wished to know whether there was any limit to their reserve-fund, or whether it depended upon the amount of capital.

Mr. WIGGIN said the reserve was limited to 10 per cent. upon the amount of the nominal capital. If the corporation did not buy the concern, their present difficulty was a passing cloud; but if they did take to it, it was, no doubt, an absolute loss.

Mr. W. HARTLE thought the lesson of the occasion was that if they had not watched the proceedings of the company as they ought to have done in the past, they should do so in the future; and what had taken place with regard to other companies might be a stimulus to their board to use extra exertions and watchfulness. He felt that they had no reason to despair, but that the gloom they were then in would quickly pass away.

Mr. SMITH thought that there was one thing they ought to remember which made their capital on the credit side rather less than it appeared on the balance-sheet. They had written off nothing for depreciation since 1871; and if it was right in 1870 and 1871 to write off £5000 each year, it was right to assume that £10,000 ought to have been written off since, by which amount their capital would have been reduced. He thought it was a strange thing that one man should go and make contracts for coal independent of the directors.

Mr. WIGGIN: I did not say that. I said that Mr. Young undertook a great portion of the work, no doubt, but it came before the directors.

The CHAIRMAN said the course adopted was to bring all the contracts before the directors before they were settled. There might be one or two purchases made by Mr. Young, which were of no moment, and did not affect the question; but the practice was to bring the answers to their requests for the price of coal before the board, who decided upon them according to the best of their power.

Mr. WIGGIN, in answer to further questions by Mr. Smith, stated that in their balance-sheet they carried over a large balance of coal from Midsummer, 1873. They did not get the high-priced coal until they had run on some time into the second half year. The coals mentioned in the present balance-sheet were taken at cost price, and they would for some time suffer the disadvantage of working out £30,000 worth of the high-priced coal. With regard to their debts, they would, if the concern was transferred to the corporation, be taken with it as part of the concern, the corporation taking to it stock, lock, and barrel.

Mr. S. HARDING considered it was purely a question of coal. Although it was said that other companies had been able to do what they had not, he asked them to look at the position of their shares in the market.

Mr. MARLOW said he thought the directors had made a grievous error in making contracts for coal for twelve months when the price was so high.

The CHAIRMAN said they had not a telescope by which they could see into the future; but the directors exercised their collective judgment, and if Mr. Marlow had been a member of the board he would no doubt have done as they had.

Mr. WIGGIN: We can all be wise after the event.

Mr. HARDING asked whether it was anticipated that the reserve-fund would have to be drawn upon next half year.

The CHAIRMAN said he would not venture to prophesy what they would require at the end of the half year. It was possible that the balance of profit might not be quite equal to the amount required to pay the dividend; but if he was to give them his own individual opinion, it was that, if not quite, it would be very nearly equal to it, and that at the end of the succeeding half year, such was the stream of circumstances flowing in their favour, they would be able to pay their dividend, and have an excess to recoup a part of that which they had drawn from the reserve-fund.

After some further conversation,

Mr. JAFFRAY said, with reference to this question of contracting for coal, he might tell the meeting what, no doubt, many of them knew, that the practice of the great railway companies, as well as of gas companies, was to contract always for one year—from June of one year, when coal was supposed to be at its lowest price, to June of the following year. With reference to the folly or wisdom of contracting for twelve months, at a time when coal was at so very high a price, he was able to state, from personal knowledge, that the directors of the Midland Railway, who were shrewd, keen men, broached the idea of contracting for two years at the then existing high price. It was the universal practice of such large companies who had large responsibilities to the public to contract for twelve months. Had they last year contracted for a lesser period, the consequence would have been that at the end of six months they would not have been able to contract at all; for one of the companies came to a colliery of which he had some knowledge, to beg at any price to be supplied with the quantity which they had not fully contracted for. This showed that there was not only wisdom in the general rule, but in that special case, of contracting for a lengthened period, when coal was at its highest price, but when to everbody's mind its tendency was to rise rather than to fall. With regard to the system of soliciting tenders, the directors knew, or ought to know, the special market to which to go for their supply, just as the railway companies did who required a particular kind of coal for locomotive purposes. They sent their forms of tender to a score or more of such collieries, and when these were returned they selected from them that which was the most advantageous. It was not a system of advertising at all, but a system of selecting the best coal and the nearest, transit being an element of cost. He did not know whether or not this was the system the directors pursued, but it was the one which they ought to pursue. So much for the question of coal. There was another question which he wished to make a remark upon. The statement which had given him more satisfaction than any general explanations was, that now and henceforth they would have a Permanent Works Committee, to supervise all the arrangements at their works, and, at least once a week, to examine the results of the processes going on there. In private establishments, as in public, a long career of prosperity led to comparative ease, and—should he say it?—negligence and relaxed supervision. He apprehended that such had been the case, to some extent, in this company, and had led to the results which had been laid before them, a system of supervision which was good enough in the past, but which was not sufficient for these times. He now heard with satisfaction that henceforth they would have a Works Committee to inspect periodically the whole arrangements at their works, and test from time to time the produce of their manufacture, and prevent that daily leakage which, more than the price of coal or the labour question, had brought about their present position.

The motion for the adoption of the report was then put and carried, and the usual dividends of 10 per cent. and 7½ per cent. were declared, payable on the 29th inst.

The retiring directors were re-elected, and the meeting closed with the usual votes of thanks.

CRYSTAL PALACE DISTRICT GAS COMPANY.

The Ordinary Half-Yearly General Meeting of this Company was held on Thursday last at the London Tavern—Professor ERASMUS WILSON, F.R.S., in the chair.

The SECRETARY (Mr. Magnus Ohren) having read the notice convening the meeting, the seal was affixed to the register of shareholders. The following report and statement of accounts was then submitted:—

The directors have to report that increased care has been bestowed upon the company's operations, but that, owing to the serious depreciation in the value of coke, and the effect of the high price of coal on the stock left in the former half year, the balance of profit and loss this half year is not sufficient to pay the full statutory dividend. The shareholders will, however, be glad to learn that this crisis in the affairs of the company, which was anticipated by the directors, is provided for in the balance carried forward from former half years.

The directors have not thought it desirable to increase the price of gas to the general consumer, especially as the rental is steadily increasing, and the results of the carbonizing department for the past half year are satisfactory.

The directors also report that they have purchased, on advantageous terms, the land on which the old works stand, and that the whole of the land in the possession of the company is now freehold.

The reports of the chemical adviser of the company and of the medical officers of the parishes supplied by the company, on the illuminating power of the gas, and its freedom from sulphuretted hydrogen and ammonia, continue to be satisfactory. During the half year 14 visits have been made to the new testing-station (without notice) by Dr. Letheby on the part of the company, and Dr. M'Cormack and Mr. Heisch on behalf of the parishes of Lambeth and Lewisham respectively; and the average result of these examinations of the gas has given an illuminating power of 15·06 standard sperm candles.

The accounts annexed show the financial position of the company. After carrying £1000 to the reserve-fund, the balance of profit and loss account amounts to £9070 17s. Out of this sum the directors recommend the declaration of a dividend at the rate of 6 per cent. per annum on the preference capital; a dividend at the rate of 7 per cent. per annum on the ordinary 7 per cent. capital; a dividend at the rate of 10 per cent. per annum on the original capital; a dividend at the rate of 7 per cent. per annum on the converted 7 per cent. capital; and a dividend at the rate of 10 per cent. per annum on the converted 10 per cent. capital; all free of income-tax; which will absorb £7847 17s. 1d., and leave £1222 19s. 11d. to be carried forward to the profit of the succeeding half year.

A.—STATEMENT OF SHARE AND LOAN CAPITAL.

Acts of Parliament regulating the Capital of the Company.	Description of Capital.	Maximum Dividend authorized.	Number of Shares issued.	Nominal Amount of Shares.	Called up per Share.	Total paid up.	Amount unpaid or unissued.	Total Amounts authorized.
21 & 22 Vict., cap. 192	Ordinary.	10 per cent.	5,000	£10 0 0	£10 0 0	£50,000	..	£50,000
Ditto ditto	Preference.	6 ditto.	5,000	10 0 0	10 0 0	50,000	..	50,000
Ditto ditto	Converted.	10 ditto.	2,500	10 0 0	2 0 0	5,000	£20,000	25,000
Ditto ditto	Loans.	..	..	..	..	5,825	..	..
28 Vict., cap. 32	Ordinary.	7 per cent.	10,000	10 0 0	10 0 0	100,000	..	100,000
Ditto ditto	Converted.	ditto.	2,500	10 0 0	2 0 0	5,000	20,000	25,000
36 Vict., cap. 59	Ordinary.	ditto.	..	10 0 0	10 0 0	..	150,000	150,000
Ditto ditto	Loans.	..	..	..	..	..	37,500	37,500

B.—STATEMENT OF COALS USED DURING THE HALF YEAR.

Description of Coal.	In Store, Dec. 31, 1873.	Received during Half Year.	Used during Half Year.	In Store, June 30, 1874.
	Tons.	Tons.	Tons.	Tons.
Common	7,887	16,972	15,122	9,737
Cannel	290	576	206	660
Total	8,177	17,548	15,328	10,397

C.—STATEMENT OF RESIDUAL PRODUCTS MADE AND DISPOSED OF DURING THE HALF YEAR.

Description of Residual.		In Store, Dec. 31, 1873.	Made during Half Year.	Used in Manufacture during Half Year.	Sold during Half Year.	In Store, June 30, 1874.
Coke	chaldrons	2,517	15,328	1,823	10,749	5,273
Breeze	,,	..	982	..	672	310
Tar	gallons	29,900	133,864	..	159,818	3,946
Ammoniacal liquor	,,	17,677	..	256,458	..	19,446
Sulphate of ammonia	Tons	24½	116	..	122	18½

D.—CONTINGENT-FUND ACCOUNT.

Dr.		*Cr.*	
To Balance, June 30, 1874	£10,367 13 4	By Balance, Dec. 31, 1873	£10,367 13 4
	£10,367 13 4		£10,367 13 4

E.—RESERVE-FUND ACCOUNT.

To Balance, June 30, 1874	£1,136 18 5	By Balance, Dec. 31, 1873	£134 14 0
		Profit and Loss Account, J.	1000 0 0
		Interest on amount invested	2 4 5
	£1,136 18 5		£1,136 18 5

F.—INSURANCE-FUND ACCOUNT.

To Balance, June 30, 1874	£365 11 11	By Balance, Dec. 31, 1873	£244 11 11
		Revenue account	121 0 0
	£365 11 11		£365 11 11

G.—CAPITAL ACCOUNT.

	Expenditure, Dec. 31, 1873.	Expenditure Half Year.	Total to June 30, 1874.		Certified Receipts to Dec. 31, 1873.	Received during Half Year.	Total Receipts to June 30, 1874.
To Expenditure to Dec. 31, 1873	£194,001 11 11		£194,001 11 11	By Ordinary shares	£50,000 0 0	..	£50,000 0 0
Since Dec. 31, 1873—				Preference shares	50,000 0 0	..	50,000 0 0
Lands acquired	..	£1,264 14 8	..	Ordinary 7 per cent. shares	99,271 0 0	729 0 0	100,000 0 0
Buildings, manufacturing plant, storeage, and other structures connected with manufacture	..	46 14 0		Converted 10 per cent. shares	..	5,000 0 0	5,000 0 0
New mains and service-pipes, including laying, paving, and other works connected with distribution	..	3,471 5 7		Ditto 7 per cent. shares	..	5,000 0 0	5,000 0 0
Meters (additional), including fixing, also gas stoves and regulators	..	377 19 8		Loans £5,825 0 0			
		£5,160 13 11		Less repaid 100 0 0	..	..	5,725 0 0
Less—depreciation on meters		464 15 2	4,695 18 9				
Total expenditure	..	..	£199,097 10 8				
Balance of capital account	..	..	16,627 9 4				
			£215,725 0 0				£215,725 0 0

H.—REVENUE ACCOUNT, *for the Half Year ended June 30, 1874.*

Dr.			*Cr.*		
To Manufacture of gas—			By Sale of gas—		
1. Coals, including all expenses		£21,207 0 3	Lady-day quarter—		
2. Purifying materials, wages, &c. £626 5 6			1. Private rental—		
Less spent oxide sold 270 10 10			6,042,400 cubic feet, at 4s.	£1,208 9 4	
	355 14 8		77,365,000 cubic feet, at 4s. 2d.	16,117 14 3	
3. Salaries of engineer and officers	473 0 0		2. Public rental and under contracts	1,658 1 3	
4. Wages and gratuities	2,163 4 7				18,984 4 10
5. Works, machines, and apparatus—maintenance of, repairs, and labour £1,911 1 0			Midsummer quarter—		
Less old material sold 147 9 7			3. Private rental—		
	1,763 11 5		4,448,800 cubic feet, at 4s.	889 14 11	
5A. Retorts, renewal and repairs	634 17 11		39,182,800 cubic feet, at 4s. 2d.	8,163 1 5	
		£26,597 8 10	4. Public rental, and under contracts	1,410 2 8	
Distribution of gas—					10,462 19 0
6. Salaries of chief inspector, inspectors, and clerks in light office	496 5 4		5. Meter-rental—the half year		307 8 5
7. Mains and service-pipes, repairs, maintenance, renewal, and labour	448 6 9				£29,954 12 3
8. Meters, repairing, renewing, and refixing	709 5 0		Residual products—		
		1,653 17 1	6. Coke, less labour and cartage	7,195 19 10	
Public lamps—			7. Breeze, ditto	263 13 9	
9. Lighting and repairing		543 12 0	8. Tar, ditto	903 5 11	
Rents, rates, and taxes—			9. Sulphate of ammonia and ammoniacal liquor, less labour, &c.	1,149 9 5	
10. Rents	20 17 0		10. Sundries	197 6 11	
11. Rates and taxes	987 3 4				9,709 15 10
		1,008 0 4	11. Rents		10 0 0
Management—					
12. Directors allowances	500 0 0				
13. Salaries of secretary, accountant, clerks, and messenger	400 4 0				
14. Collectors commission	650 14 2				
15. Stationery and printing	235 9 6				
16. General establishment charges	435 13 6				
17. Auditors	30 0 0				
		2,252 1 2			
Sundries—					
18. Law charges		35 19 4			
19. Bad debts		134 9 5			
20. Horses and carts		271 17 3			
21. Insurance-fund (F)		121 0 0			
Total expenditure		32,618 5 5			
Balance carried to profit and loss account (J)		7,056 2 8			
		£39,674 8 1	Total receipts		£39,674 8 1

J.—PROFIT AND LOSS ACCOUNT (NET REVENUE), *for the Half Year ended June 30, 1874.*

To Amount carried to reserved fund account (E), from profits of half year ending June, 1874		£1000 0 0	By Balance of net profit from last account	£10,476 3 11	
2. Interest on temporary loans		0 0 0	Less dividend paid for the half year ended Dec. 31, 1873	7,428 3 4	
3. Interest on loans on bonds accrued to June 30		138 7 3			£3,048 0 7
Balance of net profit to be carried to next account, subject to half year's dividends to June 30		9,070 17 0	2. Balance brought from revenue account (H), being profit for the half year		7,056 2 8
			3. Interest on moneys deposited		105 1 0
		£10,209 4 3			£10,209 4 3

K.—GENERAL BALANCE-SHEET, *on June 30, 1874.*

1. To Capital account (G), balance		£16,627 9 4	1. By Cash at bankers		£3,780 14 9
2. Profit and loss account (J), balance		9,070 17 0	2. Deposit at interest		8,154 13 5
3. Contingent-fund (D), balance		10,367 13 4	3. Reserve-fund, invested in £150 Consols		134 14 0
4. Reserve-fund (E), balance		1,136 18 5	By stock of		
5. Insurance-fund (F), balance		365 11 11	4. Coals	£15,306 14 0	
6. Unpaid dividends		50 19 11	5. Coke and breeze	3,241 17 9	
7. Sundry tradesmen and others, for amount due for coals, stores, &c., to June 30, 1874		10,992 16 9	6. Tar	32 17 8	
			7. Sulphate of ammonia and ammoniacal liquor	378 18 7	
			8. Sundry stores	4,857 9 2	
					23,817 17 2
			8A. Retort account		618 17 8
			By amount due for		
			9. Private gas and meter rental	8,997 10 9	
			10. Private arrears uncollected	170 8 6	
			11. Public rental and arrears	1,426 17 5	
					10,594 16 8
			12. Coke and other residuals		1,268 19 1
			13. Sundry accounts		241 13 11
		£48,612 6 8			£48,612 6 8

The CHAIRMAN, in moving the adoption of the report, said that it spoke so well for itself that there was very little left upon which he could offer any observation. The directors had sometimes appeared before the shareholders at a time when there was some difficulty with regard to the supply of coal, and some anxiety as to how they should succeed in getting over a certain impending crisis; and it would be recollected that, although the directors spoke encouragingly with regard to it, they were not too eager in their expectations of success. Knowing the friendly disposition of the shareholders towards the directors, and that they were always willing to give them credit for their best exertions on behalf of the company's affairs, he need not assure the meeting that they (the directors) had very carefully and anxiously conducted the business during the past year, and had brought it to what might be considered a successful termination. In previous half years there had been a surplus of profit, retained under the expectation that it would, at a future period, be required for bringing up the dividend to its usual standard; and, accordingly, in the first paragraph of the report, the directors stated that though they had bestowed increased care upon the company's operations, nevertheless, in consequence of the serious depreciation in the value of coke, and the high price which had already been paid for coal, there was a deficit on the profit side of their gains, which placed them in the position of not being able to declare the ordinary statutory dividend; but that, thanks to the foresight which they had exercised in anticipating such a probability, they had in hand such a sum as would enable them to pay the ordinary dividend which had been paid for a number of years. The other alternative, as they all knew, would have been to have increased the price of gas to the consumer; but this the directors carefully and strenuously avoided; and in spite of resisting the temptation which existed to make such an increase, they had been enabled, by means of the setting aside of a portion of their profits, to place themselves before the shareholders in a position perfectly satisfactory, as they hoped, in connexion with the business that had been transacted during the half year. The second paragraph of the report stated that the rental was steadily increasing, and that the results of the carbonizing department for the past year had been highly satisfactory. The increase during the half year over the corresponding half of last year amounted to £2579, so that it would be seen that the directors had not been idle, and that by means of legitimate and well-deserved profits, the result of care and industry, the company were still in a thriving condition. The shareholders had probably become aware through the newspapers that a complaint had been made by the Lewisham Board of Works that the company's gas contained, on one occasion, more than the 20 grains of "sulphur compounds" per 100 cubic feet permitted by the company's Amendment Act obtained last session of Parliament. Mr. Heisch, the gas examiner to the Lewisham Board, was the first to test for "sulphur compounds" with the new apparatus fixed by the company in accordance with the Amendment Act, and Mr. Heisch had no doubt found the "sulphur compounds" above the parliamentary standard; but, so soon as it was brought to the knowledge of the directors, their engineer was instructed to take immediate steps to reduce the quantity, and to spare no expense in complying with the Act. The gas, when next tested by Mr. Heisch, was, he reported, 10·10 grains, and the average of the tests taken by Dr. Letheby during the last three months gave an average of 12 grains, one test being as low as 7½ grains. He (the chairman) doubted very much whether it would be beneficial to reduce it lower, and it could only be done at great expense. He desired to impress upon the shareholders that this company's gas had always been free from *sulphuretted hydrogen*, and also from ammonia, and was so stated by Mr. Heisch when he reported to his board that the "sulphur compounds" were in excess. The third paragraph stated that the land upon which the works were built was now entirely freehold. The portion which the directors had purchased themselves was freehold, but that which came into their hands in the first instance—the ground occupied by the old Sydenham Gas Company—was leasehold, the acquisition of which became a matter of considerable importance. He was now glad to be able to state that the company at the present moment were in possession of about 15 acres of land which was entirely freehold. The directors had long had it in contemplation to endeavour to reduce, as far as possible, the amount of Sunday labour. They were not pressed to that by any stimulus from without; but they felt that, if it were possible by good management and good engineering to secure rest for the men on the Sunday, it would be their duty to endeavour to carry it out. There was some little difficulty where it was least to be expected—namely, from the men themselves, who felt that in losing a Sunday they were losing a day's wage. The difficulty was, however, got over, and he was now proud and happy to announce that the men left off work at twelve o'clock on Saturday night and resumed it at twelve o'clock on Sunday night, thus giving them the full 24 hours. This was a point of excellence which had not been generally attained by other companies, although a few of them had managed to give their men 12 hours. He trusted that the 24 hours arrangement would continue through a considerable portion of the year, although occasionally, upon an emergency and at particular seasons, the men would be required to labour a few hours on the Sunday. The last paragraph in the report explained the state of the finances; but, as it was a somewhat long one, he would not advert to it further than to say that the directors were enabled fairly and rightfully to offer to the shareholders the full dividends which by Act of Parliament they were entitled to offer, and that a surplus of £1200 would be left, which would be carried to the profit of the succeeding year. He thought that the company could hardly be in a more healthy condition than it was at present. He would therefore conclude by moving—"That the report of the directors and the balance-sheet confirmed by the auditors be received, adopted, and entered upon the minutes."

Mr. LINGING seconded the motion.

In answer to Mr. LAYTON, Mr. WATSON, the engineer, stated that, owing to the abolition of the Sunday labour, the men were now paid six days instead of seven, at the same rate per day as formerly.

Mr. LIVESEY, in supporting the motion, complimented the directors on the report they had issued, and said that, in giving the shareholders such full details as to the state of the company, they had acted on the principle that their shareholders had the greatest right to know the exact state of their own property. He thought, however, that one of the items—"Retorts renewal and repairs" (5A in the revenue account)—should be included in general repairs and maintenance. He should like to know if the item "8A, retort account, £618 17s. 8d.," in the general balance-sheet, was a suspense account.

The CHAIRMAN: Yes.

Mr. LIVESEY (continuing) said the company deserved credit as being one of those few that had maintained their original price. Many of the London companies who were in far more favourable positions than the Crystal Palace Gas Company had raised their rates, first among whom was the Commercial, who raised the price in 1872. There was one remark in the chairman's speech which he wished to draw attention to. He (the chairman) said that the engineer had proved his power of removing every particle of sulphur from the gas.

The CHAIRMAN: Consistent with the health of the population.

Mr. LIVESEY: Then I should be very glad if the reporters would put it in that form, because I should be exceedingly sorry for it to go forth to the public that it was possible by our present knowledge to remove every particle.

The CHAIRMAN: I did not say that. I merely said that he had declared his power to accomplish it. I did not mean to say that he had done it.

Mr. LIVESEY: I doubt if he has shown his power to accomplish it.

The CHAIRMAN: He has put his power to the stretch, and we would rather prevent him from doing it, because it would be far too expensive a process.

Mr. LIVESEY said he was not prepared to admit that any one had shown he could remove all the sulphur. He thought it would be rather a dangerous statement to go forth. It was quite possible to do a great deal in that direction; but he did not think any one had shown his ability to remove every particle. If any one had shown his ability to do so, then the public would have been down upon the gas companies, and upon the Crystal Palace Company too, asking them to remove every particle, which they were not prepared to do just yet. He had very great pleasure in supporting the motion that had been put from the chair.

The report was then unanimously adopted.

On the motion of Mr. LINGING, seconded by Mr. LEA WILSON, it was resolved, "That a dividend at the rate of 6 per cent. per annum on the preference capital, a dividend at the rate of 7 per cent. per annum on the ordinary 7 per cent. capital, a dividend at the rate of 10 per cent. on the original capital, a dividend at the rate of 7 per cent. on the converted 7 per cent. capital, and a dividend at the rate of 10 per cent. per annum on the converted 10 per cent. capital, all free of income-tax, be now declared and made payable forthwith."

Mr. H. J. CLOSE moved, and Mr. JAMES CURTIS seconded, a vote of thanks to the directors for their able management of the affairs of the company for the past half year, which was heartily accorded.

The CHAIRMAN, in responding, said that he need hardly say, on the part of himself and the other directors, that they felt very much indebted to the meeting for the vote which had just been passed. He should not have added anything more if it had not been for a remark which was made by one of the shareholders, which reminded him of the position which the directors always considered they should hold in respect to the shareholders. The directors were, in point of fact, shareholders, deputed, for the time being, with a responsibility which they were ready to take upon themselves, and upon which he hoped they should at all times be found to act with the greatest sincerity and truth. The directors knew of no interests themselves apart from those of the shareholders, and were therefore eager to give every kind of information that was within their reach, and the more so when that information happened to be of a pleasant character, and was calculated to send them home with the rather cheering feeling that the ship was sailing satisfactorily and well, which he hoped would be the case for many years to come.

Mr. JOSEPH HADLAND moved a vote of thanks to the auditors and officers of the company for the efficient discharge of their duties.

Dr. PUCKLE, in seconding the motion, said he had had great experience in gas company's accounts, and he could truly say that he had never seen any company's accounts presented in a more satisfactory form than were those of the Crystal Palace District Gas Company. The members were very much indebted to their old friend Mr. Gray, who had long filled the office of auditor, and who had great experience in accounts, and to their excellent friend Mr. Glaisher, whose experience and world-wide renown had added so much to the success of the company. Mr. Ohren, the secretary, had long been known to the shareholders, who could not fail to appreciate that gentleman's urbanity of manner, kindliness of disposition, and the way in which he devoted his heart and soul to the interests of the company. Mr. Watson he had known for a shorter period, but it was a great thing to see that he knew his work, and the efficient manner in which he performed it. In whichever way the accounts were looked at, they would present the most satisfactory result, except, perhaps, as regarded the amount which had been received for coke, which had been entirely beyond the control of any director or officer of the company. It was satisfactory to find that there had been an increased supply of gas, both to private consumers and public lighting, with a decreased consumption of coal in the manufacture. This was, no doubt, due to the very careful attention of Mr. Watson, the engineer, and had enabled the directors to continue to supply gas at their original price, which, he thought, was extremely low, considering that the company was not one of the largest, and might even be considered a suburban company. He had great pleasure in seconding the motion.

The motion having been put to the meeting, was carried unanimously.

Mr. GRAY (one of the auditors) in reply, thanked the meeting for the hearty manner in which the motion had been put and carried. He said that the auditors had always striven to do their duty in the past, and would endeavour to do so in the future.

A vote of thanks to the chairman terminated the proceedings.

GLASGOW CORPORATION GAS SUPPLY.

The Glasgow Town Council had before them, at their Meeting on the 17th inst., the gas accounts for the past year, the approval of which was moved by the LORD PROVOST.

Mr. FINLAY seconded the motion. He had, he remarked, examined the accounts in the office since last meeting, and had been received with every courtesy. There could be no doubt that in connexion with these accounts there was fault somewhere, and that their "make" from a ton of coal was very small. That fault might lie within the walls of their own works. It might arise from the quality of the coal supplied to them, or it might be due to both of these causes; but he believed that the committee were quite able of themselves to put matters right, and he hoped they would do so before the expiry of another half year.

Mr. MACKENZIE said the accounts seemed to him most unsatisfactory, and proceeded to refer to various matters to which he took exception. He had ascertained that the amount of coal consumed during the year was 187,814 tons 13 cwts., and that the amount of gas produced was 1,604,125,000 feet, or 8541 feet per ton, the amount sold being 1,305,811,000 feet. The leakage was estimated at 131,761,852 feet, but that was mere guess work on the part of the officials. At last meeting he asserted that they should produce 10,000 feet of gas from every ton of coal, and he had been procuring information with the view of proving this statement. He had hoped to be able to produce returns from the principal gas-works in the country before next meeting, but the meeting had taken place sooner than he anticipated. He had obtained, however, more than one certified document from large public gas-works, showing that their annual product had been more than 11,000 feet per ton; and as they were only producing 8541 feet, that showed that blame must rest somewhere. The consequence was that the price of gas to each public lamp was 21s. 10d., whereas in a neighbouring burgh the lamps cost only 14s. 8d. for 9 months, or 16s. 1d. for 12 months, the illuminating power of the latter lamps being at least equal to that of those belonging to the corporation. If they had produced 10,000 feet of gas per ton, the total amount would have been 1,878,150,000 feet, which at their average price would have given £69,648 additional revenue; or had they been smart, like some of the enterprising companies, and produced 11,000 feet, that would have given £117,384 additional revenue, or, deducting 20 per cent. instead of 18½ allowed by Mr. Miller for leakage, £92,907. He thought, in consideration of these figures, it was the duty of the committee to set themselves to produce more gas, that they might be able to give it at a lower price. No company were in a better position for working economically, for they had an enormous consumption within a small radius. There was nothing equal to it out of London.

Treasurer MILLER said he thought, from the great flourish of trumpets with which Mr. Mackenzie began, that they were going to get a great deal of information. But he had given them none, only telling them what they all knew before. On a former occasion in which he addressed the council he referred to the question of capital, accusing the committee of extravagance; and as there was nothing like comparison to show the accuracy of these statements,

he would contrast the present condition of their concerns with the state of things under the old companies. The capital expended by the old companies upon their works was £320,000, and with that they were able to produce 6,500,000 cubic feet of gas per day, and they had gasholder accommodation for 4,418,000 feet of gas. The corporation, since the works came into their hands, had expended upon them in repairs and enlargement a sum of £363,500, and they had additional power of production to the extent of 5,383,000 feet, and additional gasholder power to the extent of 7,500,000 feet. Then he had compared the capital of the Glasgow Corporation with that of some of the neighbouring towns and cities nearest to it in size, and the nearest was Liverpool. The following were the comparisons:—

	Liverpool.	Glasgow.
Capital	£1,068,600	£1,044,000
Do. in works, piping, and meters	987,800	984,800
Cost of manufacture	307,800	253,400
Revenue from gas	317,000	324,000
Revenue from coke and tar	77,300	31,500
Revenue from meters, rents, and fittings	14,500	Nil.

He recommended this latter item to the attention of Bailie Collins. Of the four largest companies in London, the average outlay upon capital per ton of coal carbonized was £7 8s., and the average of the whole of the companies, 12 or 14 in number, was £6 6s. The average [illegible] nearly £1 per ton less upon the coal carbonized, [illegible] a little cautious before he entered on that q[illegible]d with another gas-work, and he (Mr. Mille[illegible]kenzie was charging them so grievously, to s[illegible]elf. He found that against £5 11s. of capital per ton of coal car[illegible] by the Glasgow Corporation, the company in which Mr. Mackenzie was interested spent no less than £21—about four times as much as Glasgow. He would say no more about the question of capital. Complaints had also been made about the small quantity of gas taken out of each ton of coal used. Now this was entirely a question of manufacture—whether it was best to use a cheap coal with a small return, or a dear coal with a greater. Now, he found that in 1873 the return was 9228 feet per ton. Of course, they could have taken the same return out of their coal during the past year had they used the same coal, but by a little good management, and by buying a cheaper article, they saved 1s. per ton on all the coal bought, or not less than £9000 during the year. As he had said, the question of the quantity of gas taken out of the coal was altogether a question of manufacture. Different managers had different opinions, and Mr. Foulis had acted to the best of his judgment. He had tried, in the critical condition of the coal market, to economize coal as much as possible, and he thought by using a low-priced coal he could get as good a quality of gas at a lower price. It would have been easier for Mr. Foulis to take more gas out of this coal, but everybody knew that if gas was taken out of coal beyond a certain point, the quality of the gas was seriously affected. It would never do, therefore, for Mr. Foulis to adopt that course. Then, by using, as another company in the neighbourhood had done, a coal costing 25s. per ton, instead of 20s. as he was doing, he could have got 10,000, probably 11,000 feet of gas per ton, but it would have been at a very serious loss of money. To take the case of Edinburgh, he found that during the past year they had been using a coal costing 25s., from which they got 9256 feet per ton, and any one could calculate whether they had done better than the Glasgow Corporation. In the previous year they, like the Glasgow Corporation, were using shale, and they got out of it 8100 feet per ton against 8535 feet per ton Mr. Foulis had produced. He had also looked into the returns of the old companies, and he found that in 1861, the last year at which their price was 5s., their coal cost 14s. 8d., against 20s. 4d. in 1874, the price charged for the gas being the same. In 1866 their coal cost 12s. per ton, and the gas 30¼d. In 1874 the corporation paid for their coal 20s. 4d., and their gas cost 45½d., being a saving of about 2s. 4d. per ton, proving that the gas at the present time cost no more for wages and general expenses than did that produced by the old companies, although everything was so much advanced in price. The result of his most careful and unprejudiced examination into these matters had been to produce in his mind a strong conviction that in Mr. Foulis they had a most excellent manager, who had shown the greatest judgment in the management of their affairs in these recent critical years, and that the city of Glasgow had gained very largely, and never more largely than during the last two years, in consequence of the manufacture of the gas being in the hands of the corporation.

Bailie COLLINS said there were one or two questions which he wished to put. Could Mr. Miller give any statistics with regard to the cost of producing gas in other towns besides Edinburgh? For himself, he knew of at least one town in Scotland in which gas of equal standard was being produced cheaper than in Glasgow. He had received the facts confidentially, and therefore could not name the town in open council, but he would be glad to give the information privately to Bailie Walls or Mr. Miller. Last year he asked whether a separate account was kept in respect of the manufacture of chemical products. He found that there was no separate statement under that head in the printed accounts, and he wished to know what was the result of working. Twelve months ago they were told that it paid.

The LORD PROVOST: There is a heavy loss upon it.

Bailie WALLS: There is a loss of from £1500 to £1700.

Bailie COLLINS said he wished also to know whether contracts were taken for all furnishings supplied. It would be in the recollection of the council that some two or three years ago a motion was carried by which all committees were required to take estimates from, at least, two tradesmen for all furnishings required. Had that rule been adhered to in the case of the Gas Committee?

Bailie WALLS said this had not been done in the Gas Committee.

Treasurer MILLER: I could answer that differently.

Bailie COLLINS said he would really like an explanation of the cases in which this had not been done, because the council came to a deliberate decision on the point.

Bailie WALLS said he was sorry the minutes of the Gas Committee were not on the table, because they contained the contracts about the works. He should like to make an explanation about the capital account a little different from that of Treasurer Miller. This matter had been occupying public attention lately, and had been alluded to in one of the leading public journals of the country. The capital employed by the gas company was £1,044,000, and it was necessary to know how that portion of it which had been borrowed since the gas was taken up by the corporation had been applied. It had been applied first in improvements and extensions at Dalmarnock, to the extent of £74,184; at Townhead, to the extent of £32 only; at Tradeston, £55,832; at Partick, £2347; at Dawsholm, £234,522; at the chemical works, £11,327; and for workshops at Alston Street, £1651. There had been expended on pipes, which were a most important item, £98,435; on meters, £55,040; on counting-house furniture, £310; and on the ground at Lancefield Street, £2, making a total of £534,026 17s. 8d. The capital borrowed to meet that had been to the extent of £510,374. Properties had been sold to the extent of £19,770. So much for the manner in which the borrowed capital had been expended. It was also anticipated that the Townhead works would be closed—in fact, they were already closed. The property in Alston Street, which stood on the books at £3792, had been sold for £18,000, and that in Lancefield Street at £11,370. He anticipated that by the sale of the Townhead works there would be a surplus from the machinery and property equivalent to £7000. The property in the Old Wynd, he presumed, would be soon sold, and would realize a surplus of about £530 over the amount at which it stood in the books—viz., £1470. The Partick works, it was also anticipated, would be closed before long. They stood in the books in round numbers at £19,000. As he had said, they would be able to do away with the Partick works, and it was anticipated they would sell them at a profit equal to £5000; but it would be necessary that the main-pipe be taken from the Dawsholm works into Partick in order to supply that district. He anticipated, therefore, that by the end of next year they would have their capital account reduced about £40,000 or £42,000. With reference to the losses of the last two years—1873-4—they amounted to £40,109. His calculation, in accounting for that deficiency, was that they lost by the non-fulfilment of contracts in 1872-3 at least £10,000; interest for non-productive capital at Dawsholm, £9120; loss from inferior coals, £15,050; loss on cartage, £3822; and loss on chemicals, £1700. The amounts he had mentioned made up the sum of the losses as nearly as possible during the last two years.

The motion of the Lord Provost was then adopted.

DEWSBURY CORPORATION NEW GAS-WORKS.

It was reported in the last JOURNAL that the ceremony of cutting the first sod for these works was performed by the Mayor of Dewsbury on the 17th inst. We have now the pleasure of supplying a description of this important undertaking, which is abridged from the *Dewsbury Chronicle*.

The works, which are to be erected at Savile Town, will be placed on a plot of land about 10 acres in extent, and approached by a street now in course of construction, the trustees of the Savile estate. The site is between the river Calder on the left, near the weir, at Sands Mill, and the Old Cut belonging to the Aire and Calder Navigation Company, on the right. We understand that this company intend, at no distant date, to construct a large basin, or dock, and build commodious warehouses at a point just below the works. In order to further this scheme, the temporary wooden bridge which crosses the cut, and by which access from the site of the gas-works to Slaithwaite Lane is obtained, by way of Bretton Street, will be removed, and a substantial structure of much wider span will be erected in its place. This will form a direct thoroughfare from Savile Road to the new works. Besides this, we understand that the Gas Committee of the Town Council are negotiating with the Lancashire and Yorkshire Railway Company for sidings from the gas-works yard to their line at Thornhill Junction. For all practical purposes there could not have been a better site chosen than the one in question, as it is easy of access by "road, river, or rail." Although "the first sod was turned" on Thursday afternoon, there are already about 100 men employed on the works—excavating and building temporary blacksmiths shops, places for workmen, a store-house for lime used in the manufacture of concrete, stables, &c. A number of men, too, are engaged at a large quarry recently purchased at Millbank, Thornhill, their work at present being chiefly confined to baring the stone, which when quarried will be conveyed by means of boats to a temporary landing stage erected on the left bank of the Old Cut. The baring is being used for making the foundations of the principal roads. A great deal of filling will be required to be done, in order to raise the works above the level of the river, but this will be completed by degrees. As the depth of filling measures 7 feet 6 inches, it necessarily follows that a long time must elapse before this work can be completed. When it is finished, however, the level of the yard will be 2 feet 6 inches above the bank of the canal. The Ordnance datum varies from 109 to 110 feet above the level of the sea. Workmen are at the present excavating for the base of a tank which, when constructed, will be 122 feet in diameter and 26 feet 6 inches deep, and it will allow of a gasholder of a capacity equal to half a million cubic feet of gas. This tank and holder are the first of a series which will be put down from time to time as the increased requirements of the district demand an increase in the size of the works. We have no doubt but that the engineers will have considerable difficulties to cope with, from the fact that they will have to remove a quantity of water from the excavations. The geological strata run thus: earth, 5 feet; clear sharp sand, which can be used for building purposes, 2 feet; and a boulder bed (the stones increasing in size from the top). At about a foot from the top of this bed there is a considerable quantity of water, which will have to be removed by means of steam-pumps. The tank will be sunk 15 feet below the natural level, or present surface of the earth, made up earth will be 7 feet, and there will be an embankment built 7 feet above the raised earth; making a total depth of 29 feet. At the bottom of the tank will be placed 2 feet of concrete, but 3 feet will be laid beneath the pillars. When the works have been extended to their utmost (at least, so far as present contemplations go), the corporation will be able to manufacture 3 million feet of gas per diem. In connexion with the present works, a retort-house, 220 feet in length, and capable of producing one million feet of gas per day, will be built near the large tank; and on the oblong side of this, running parallel with it to the same length, a coal store, capable of containing 3000 tons, will be placed. Each retort-house will have its own condensers, so as to make the works up to this point distinct in themselves. This work will be commenced immediately, and, when finished, there will be sufficient storeage to supply two retort-houses. A second one will be erected close to the store and parallel with the first one alluded to. It is understood that the corporation are about to give instructions to their manager to advertise for tenders for the construction of the purifiers required in the works; for the building of sheds for the storeage of oxide of iron; and for the erection of a large tar well, capable of containing 1000 tons of tar and ammoniacal liquor. It is intended to place these beneath the shed. Adjoining the purifying-house will be the oxide and revivifying house, with tar-tank underneath, capable of storing 1000 tons. An iron roof will cover the purifying-house, bearing on the wall on one side, and on the other side on columns and girders. These girders will also give a bearing to one side of the roof of the oxide-house, and a similar row will sustain the other, and also give bearing to one side of the roof of the future purifying-house. In proximity to the purifying-house, a building will be erected to contain station-meters, governors, and testing apparatus. Besides the gas-works proper, tenders will be required for the erection of offices for the weighmen and engineers, and workmen's houses (one being for the foreman of the works, and three cottages), station-meter house, governor-house, and permanent smiths shops, as well as for several store-rooms, boiler and engine houses; and the building of these will be followed by the laying down of powerful steam-engines and boilers. The former will be built near the entrance gates. The principal road on the works will run from the entrance nearly in centre of the site, and will divide the retort-houses and coal stores from the purifying and other houses. Another road, parallel to the above, and adjoining the Old Cut, will be used for supplying coal to the retort-houses and stores from the intended railway sidings and canal. Steam power will be used for unloading coal, lime, &c., and for loading coke, &c., to the railway and canal. Efficient scrubbing and washing apparatus will be erected near the purifying-house. The latter will be 125 feet long by 48 feet wide, inside dimensions, in which will be placed a set of six purifiers, each 24 feet long by 16 feet wide. This house will admit of an increase of two additional purifiers. If the corporation be successful in their negotiations with the Lancashire and Yorkshire Railway Company, a vast amount of trouble and expense will be saved by a siding being run from the company's line into the works, as the carting of coal, coke, lime, stone, iron, &c., is a material item in gas-works expenditure. Boats will be run alongside a jetty when the works are completed, and by this means tar will be removed, the liquid being run into them by means of a pipe laid at a sufficient gradient to allow it to run into the vessels without the use of pumps. This will save considerable labour and money. As we have before stated, there are at present about 100 men—excavators, bricklayers, quarrymen, &c.—on the job. Mr. George Biddle, the

borough surveyor, is the architect for the buildings; Mr. A. D. Carter is the draughtsman and assistant engineer; and Mr. Richard Broderick, late superintendent of the Dewsbury, Batley, and Heckmondwike Water-Works extension, at Dunford Bridge, is the clerk of the works—the whole being under the management, superintendence, and direction of Mr. Charles Arthur Craven, the active and indefatigable manager of the Dewsbury and Batley Gas-Works, by whom the new works have been designed. The corporation, and in fact the public generally, have every confidence in the ability of the last-named gentleman to complete the stupendous undertaking.

ON THE GEOLOGY OF COAL AND COAL DEPOSITS IN THE BRITISH ISLANDS.

By R. Etheridge, Esq., F.G.S., &c., Royal School of Mines, London.

(*Continued from page* 410.)

North Wales Coal-Fields.—Denbighshire and Flintshire.

I notice these (one of the smaller coal areas) unitedly on account of the nature and value of their mineral contents, the coals in which are important as gas and oil producers to a large extent, as well as fine house coals. The seams of coal in the Denbighshire field are not numerous—nine in number—two of which (the upper sulphurous) are not worked. The coals of the middle series are the most valuable, the seven seams unitedly realizing 30 feet of coal. The Ruabon coals are worked at Hafod to the depth of 1500 feet. The Flintshire and Denbighshire coal-fields were undoubtedly deposited in one area and as one land surface, now divided by the Millstone Grit, and severed by the great Bala fault.* This dislocation it is that geographically and geologically separates the two areas into two workable coal-fields—is, indeed, the physical feature and cause of their now disunion or severance. The Denbighshire coal-field is 18 miles long by 4 in width, and also rich in argillaceous iron ores, the "brassy and black band" beds having furnished 34,000 tons for the Brymbo and Frwd furnaces in 1869. The amount of coal raised by 23 collieries is now over 1,500,000 tons. The store known is 1287 millions of tons down to 4000 feet. Exhaustion at this output will last us 800 years. Mr. Hull does not estimate the store at more than 700 millions; the commissioners the larger total above. These differences arise from their estimating many thin seams which may never be utilized.

The Flintshire coal-field extends for 15 miles along the western side of the estuary of the Dee to the Point of Aire. It is greatly faulted along the coast; the coal seams dip beneath the estuary, reappearing through a fault near Parkgate, and underlie the New Red Sandstone of the Wirral promontory and the Cheshire plane. There is no doubt whatever about the correlation between the coals of the Denbighshire and Flintshire fields; the seams are the same under different names. So with the "intermediate" ironstone measures; they also correspond with those of Denbighshire. Cannel coals of compact structure and of high gas-producing quality constitute a portion of the "Hollin coal," and the "lower four-foot," or Leeswood, near Mold (100 yards below the main coal). This four-foot coal is reputed to yield a larger per centage of gas than the far-famed Wigan cannel, but the rich gas-producing area is limited to a comparatively small area.

These cannel coals of the English fields, parrot or gas coals of the Scotch, are not widely distributed, the most noted localities being Wigan, in Lancashire; Newcastle; Gilmerton near Edinburgh; Muirkirk, Clydesdale; Manchester; Leeswood (south of Mold), Flintshire; and Derbyshire. Dr. Andrew Fyfe gives the following assay or analysis of the Wigan and Leeswood (Flintshire) cannels:—

Wigan	12,010	cubic feet per ton.
Leeswood (curly cannel) . .	14,280	" "
" (smooth ") . .	9,972	" " †

The mean of several analyses gives the following:—

Carbon	72·22
Hydrogen	3·93
Oxygen	21·05
Nitrogen	2·08
	99·28

with specific gravity 1·23 to 1·28.

Cannel coal has been, or was, formed under very different conditions from that of anthracite, or even some of the bituminous coals. It appears to have been formed by the greater amount of maceration which the vegetable mass underwent during decomposition and carbonization, or under such conditions as permitted a more equable and thorough bituminization than in ordinary coals. Its microscopic structure, conchoidal fracture, and resinous lustre, as well as high per centage of gas, favour the belief that decomposition and maceration must have gone on to the highest condition. Its use again, as applied to ornamental purposes, tends to prove its pulpy and homogeneous structure when carbonized. Much of the coals, being faulted, and lying near the surface, have been exhausted, leaving little for future use. Deep shafts have been, and are still being, constructed in the valley of the Dee; and Bogilit and Mostyn banks will open out great stores from under the estuary and overlying New Red measures, thus paving the way for deeper explorations under the Wirral promontory, between the Dee and the Mersey. The main coal, 8 to 10 feet thick, at 103 yards deep, and the 3-feet cannel, with the oil shale and black band ironstone below, at 196 yards, are marked features in the varied vertical structure of the coal measures. The six recognized seams give a thickness of 35 feet of coal, and over the 35 square miles of area the unwrought and available coal is estimated by the Royal Commission at 718 millions of tons (this includes the tract along the estuary of the Dee and the Neston field). Mr. Hull, who estimated only for the actually exposed coal-field in 1857, estimated the contents at 54 millions of tons. In 1869, 725,288 tons, the produce of 32 collieries, was extracted. The future of this coal-field depends upon the north-easterly extension of the coal measures into Cheshire, &c. Doubtless great deposits occur. I see no reason why they should not join the South Lancashire coal-field.

Lancashire Coal-Field.

To Mr. Binney, of Manchester, must be awarded the credit of exploring and working out the structure of this, one of the most important of our coal-fields, which is 32 miles long by 6 wide, and having an area of 217 square miles, 6000 feet of coal measures, 48 seams of coal, with the united thickness of 62 feet, and a reserve of fuel for future supply, according to Mr. Dickinson, the commissioner, of 5346 million tons.‡ It is impossible here to attempt any analysis of the complicated structure of this coal-field.§ Simple details would occupy too much room, and be foreign to my object, other subjects of interest having yet to receive our attention. The outlying Trias (Keuper 3500 feet and Bunter 1250 feet = 4750 feet) is nearly 5000 feet thick, and the Permian 750 feet. These beds surround and partly cover up the western and southern parts of the field; did they do so entirely, no coal could be won, and so completely has denudation levelled the displacements caused by the numerous and great faults that traverse the area, that their effects are scarcely perceptible at the surface. One of the largest, the "Great Up-Holland fault," between Rainford and Wigan, disturbs the county vertically 1950 feet. So the Great Pendleton or Irwell Valley fault (along the valley of the Irwell), which has a downthrow of 3000 feet; and in the Wigan area, "the coal measures are divided into belts bounded by parallel faults which range N.N.W. with every variation of amount."* The main coals are the "Arley Main" at bottom of the middle series), Rushey Park, and the well-known and valuable "Wigan cannel," or 3-feet Wigan gas coal, which is not constant over the field; this seam is in close proximity to the "King coal." St. Helen's, Wigan, Chorley, and Bolton, &c., are the chief centres of activity. Mr. Binney divides the thickness of the measures into three portions—1, the upper coal-field, including the Ardwick limestone and many thin beds of coal; 2, the middle coal-field, 3500 feet, which contain all the important seams, from the Worsley 4-feet down to the Arley Mine; 3, the lower coal-field, or Ganister series.†

The cannel coal has yielded fish remains of the genera Megalichthys, Holoptychius, and Ctenoptychius, and the genus Anthracosia, an estuarine bivalve shell, characterizes several strata. Oldham, Middleton, and Ashton are enriched by the "Black Mine" 4-feet coal, which, at the Astley Colliery, at Dukinfield, lies 690 yards from the surface. The whole of the fauna, so abundantly distributed through the measures, are marine. In the upper series seven genera of fish, with annelides and crustacea, occur. The middle coal measures possess nine genera of fish, ten genera of mollusca, four crustacea, and 24 genera of plants; and the lower series six genera of fish, 16 mollusca, and 18 plants. We need not wonder at the flourishing condition of the great cities of Liverpool and Manchester, Wigan, &c., with such inexhaustible stores of convertible power at their command, and a stock of 5346 millions of tons of coal to draw upon for the future.

The Great Midland Coal-Field—Nottingham, Derby, and Yorkshire.

Physically, the coal-fields of these three counties are one, and extend from Leeds and Bradford on the north to Derby on the south, in one unbroken range united. It is the greatest continuous coal-field in England; it is also an almost entirely exposed field throughout its entire length of 65 miles, its eastern margin only being covered by the Magnesian Limestone or Permian rocks. Sheffield occupies the centre of the great field. Lister, Whitehouse, Smith, Phillips, Sedgwick, Binney, and the officers of Her Majesty's Geological Survey, have all laboured to elucidate the past history and physical structure of this great central or midland coal-field.

The superficial area is 800 square miles, with 4500 feet of coal measures, and 15 seams of coal above 2 feet, yielding 46 feet of vertical coal; 20 seams also occur from one foot upwards, giving 53 feet of coal; and, according to the Royal Commission, the remaining unworked coal is 24,441 millions of tons; that available for use 12,220 millions, after all deductions and corrections. Besides the above, a large coal tract to the east is overspread by the Permian and Trias, &c., having an area of 900 square miles, beneath which lie buried 23,000 millions of tons of coal, from which one-third must be deducted as not available, thus leaving 15,388 million of tons. The exposed and concealed coal-fields unitedly contain 27,608 million tons, the net available quantity of coal for future use. In 1870, 18 million tons were extracted. This supply allows us to estimate that 1500 years will elapse ere this coal-field will be exhausted. The coals of this field are of every kind except anthracite, and the chief seams and ironstones occur in greatest number towards the bottom of the measures. Perhaps the most remarkable of the Derbyshire seams is the "top hard" splint coal, 5 to 6 feet thick, becoming 9 feet in Yorkshire, under the name of the "Barnsley thick bed." The "black shale" coal of Derbyshire, which is also the "Silkstone coal" of South Yorkshire—with the "Kilburn coal" only developed in South Derbyshire—it is believed that the "Silkstone coal" of Yorkshire is identical with the "Arley Mine" of Lancashire, thus showing that this one seam, like many others, originally extended or spread over a tract not less than 10,000 square miles. This original continuity is also well determined by many other seams of coal, where physical and palæontological evidences, both structural and organic, prove the same conditions over large areas, and alone are sufficient to determine the uniformity of deposition and nature of the terrestrial and marine, or estuarine accumulations during these remote epochs of time. Certain plants, which make up the shales, and well-defined species of molluscs in the roofs of the coal seam, can now be identified on both sides of the Pennine chain, thus connecting the great western coal-fields of Lancashire and Staffordshire with those of Derby, Nottingham, and York, when it was one great plain, and prior to their severance through elevation and denudation. In other words, "The upheaval of the lower carboniferous rocks and subsequent denudation has rent asunder a coal-field which originally embraced that portion of the North of England extending from the coast of Lancashire and Cheshire across the Pennine chain to an undefined region" (Hull). The extension of this coal-field to the east, under the Permian and Triassic formations, probably as far as Lincoln and the Humber, is hardly matter of doubt, it being only a question of depth rather than the presence of mineral. This easterly prolongation has been proved 5 miles from the exposed coal-field at Shireoaks (Worksop), where the "top hard coal" was cut at 510 yards deep.‡ This known extension goes to show that there is a "larger extent of coal measures in this coal-field concealed than now exposed at the surface." The sinking at Shireoak tends also to show that the "Yorkshire, Derbyshire, and Nottinghamshire coal-field probably lies in the form of a basin, the northern, southern, and eastern edges of which lie underneath the New Red Permian, and other secondary strata."§ According to Mr. Woodhouse, the coal under the Permian (unworked) amounts to upwards of 8306 millions of tons; and east of the Permian escarpment the area equals 704 square miles, with 31,388,876,800 tons of untouched coal.

Great Northern or Northumberland and Durham Coal-Field.

This classical area cannot be passed over without mention both from its importance as a coal-field, the nature of its coals, and geological features. The rivers Blythe, Tyne, and Wear naturally give names to three divisions or fields—the field of the Blythe, or Blythe coal-field, Tyne coal-field, and the Wear coal-field, all really one, and all embraced between the river Coquet, near Alnmouth, on the north, to near Staindrop on the north bank of the Tees, on the south, about 50 miles in length by 20 miles in breadth, its greatest diameter near the centre narrowing north after passing the Blythe. The area again may be triply described or defined—one portion or area being a visible coal-field, the second area a concealed coal-field, the third area under the sea, the coals under which are believed to be available. The first, or exposed coal area, contains 460 square miles; the second, or concealed coal area, 225 square miles; the third, or that under the German Ocean, 111 square miles—in all, 796 square miles. From the Coquet, at Alnmouth, to the Tyne, the German Ocean limits the coal-field to the east; the Permian overlie then sets in, forming an escarpment of sandstone and Magnesian Limestone, as far as Hartlepool, from thence striking south-east to Darlington. "Doubtless from the beds rising towards the north-east, or seaward, they must ultimately result in an easterly outcrop under the North Sea."‖ The southern limit also of this basin is now known, the northern dip of the measures at Shildon being determined.¶ At Monkwearmouth Colliery the coal seams occur 2268 feet deep; this, the nature of the coast sections north of the Tyne, and the easterly rise of the coals, all confirms the opinion and

* One of the most extensive faults in Great Britain, traceable from the sea, in Monmouthshire, to Cheshire, and with a displacement of 10,000 or 12,000 feet.

† Professor Hull's "Coal-Fields of Great Britain," p. 148.

‡ Report, vol. i., pp. 9, 18.

§ Vols. i. and ii. of the Trans. Geol. Soc. of Manchester contain able papers by — Binney, Esq., F.R.S.; also the "Mem. Geol. Survey, Geol. of Oldham and Manchester," 1862. *Ibid*, Oldham, 1864. Hull, "Coal-Fields of Great Britain" (Stanford), 1873. Geol. Survey Maps of Lancashire, scale of 6 inches to mile.

* Hull, *loc. cit.*, p. 196.

† A local name for a hard, fine-grained grit, which occurs under certain coals in Yorkshire, &c.

‡ "Quart. Jour. Geol. Soc.," vol. xvi., pp. 137—145.

§ Professor Ramsay's Report of Coal Commission, vol. i., pp. 136—138.

‖ Hull, *loc. cit.*, p. 254.

¶ The evidence of Mr. Howell before the commission clearly proves this.

belief in the trough-like structure of the coal basin, whose longer axis is north and south all tending to show the probability of a large productive coal area extending beneath the German Ocean. The total thickness of the coal measures from the lowest seam upwards, is little over 2000 feet, the upper half (900 feet) contains only a few unworkable coals, and little ironstone. The middle series, from the "High Main coal" to the Brockwell coal, including the Bentham and Hutton, or Low Main, &c., is indeed a store of wealth. One of the most important coal seams in the Tyne or Newcastle area is the "High Main" or "Wallsend seam;" it is the highest workable seam (5 to 6 feet thick); in the Wear-field this seam splits into two through the intercolation of sandstone and shale due to a change of level, and surface growth during or at the time of deposition.

"The Bentham or Mandlin" 6-feet coal, 120 feet below the "High Main," is chiefly worked under the Magnesian Limestone, at Monkwearmouth. The "Low Main" coking and house coal of the Tyne or Newcastle district (Hutton coal of the Wearfield) ranges from north to south for 40 miles; to the north its character changes to that of steam coal, being less gaseous and bituminous. This change of condition is a somewhat marked feature in the seams as they range through the field, and is probably due to the original constituents of the coal, as there does not appear any cause for metamorphism through igneous or other influences, where traversed by basaltic rocks they are in the form of dykes—not sheets or flows—and therefore small and contiguous portions only of the coals are altered. The coal seams of this great field are easily worked, owing "to the general regularity of the measures." They dip at a moderate angle, usually about 1 in 20 or 25°, and are of convenient thickness (averaging from 3 to 6 feet), added to their good quality, and the usual soundness of the roof. On the other hand there are disadvantages arising from the great depth of new sinkings, the watery nature of strata, and the large amount of fire-damp (carburetted hydrogen gas) given off by many of the seams. The best and denser white-ash steam coals occur in and characterize the area some five miles north of the Tyne and Blythe. The best household and gas coals extend from the Tyne to the Wear, and from the Wear to Castle Eden, and occupy another area about Bishop Auckland. The tender coking coals are extensively worked along the western outcrops from Wylam and Ryton down to the outskirts of Raby Park.*

We may inquire into the resources and future of this long worked, yet still rich coal district, and where three elements or conditions must be carefully calculated upon—first, the visible tract of coal measures west of the Permian rocks; secondly, the concealed area beneath these newer and overlying limestones and sandstones; and, thirdly, the 40 square miles, and 14 feet thick, through four seams of sea-covered coal, estimated for by Mr. Forster. Sir George Elliot, however, differs from Mr. Forster, both as to area and thickness, taking 71 square miles and 30 feet of coal, distributed in six seams, as his standard for future resources. The available thickness of coal is 46 feet, spread over an area of 800 square miles. The Northumberland division possesses a net available quantity (after all corrections) of terrestrial coal equal to 2576 millions of tons; and the quantity under the sea may be set down as 400 millions. The land coals of Durham will realize nearly 3800 millions of tons, and those beneath the ocean, with a breadth of 3½ miles seaward, and an area of 71 miles, 735 millions nearly; the total being, according to Mr. Hull, 7,452,250,000 tons. We must not, however, forget that the Carboniferous Limestone series of the north of England and Scotland contains many beds of workable coal, which were developed or accumulated at a much earlier date than the higher and great coal tracts of Durham and Yorkshire, &c., &c. These measures or coal-fields occur along and bordering the Tweed, in Northern Northumberland, and the Esk in Dumfriesshire. These "Tuedian" coals underlie several thick beds of Carboniferous Limestone, reposing on peculiar red sandstones of Lower Carboniferous age, through which the Tweed takes its course.† Mr. Forster has estimated that the available quantity of coal from these lower carboniferous beds (after deductions) amounts to 580 millions of tons. This quantity added to those resulting from the "upper Carboniferous" or true "coal measures" of the field, will equal 8,032 million tons. The annual yield or produce is now nearly 28 millions of tons. Another 290 years may see this great region depopulated of its coal; if so, its people. The rapid increase of output or demand from this field, during the past 30 years, is due to the vast increase and wonderful development of the iron trade along the estuary of the Tees at Middlesborough. In 1859, the yield of coal was 16 millions of tons; in 1869, it reached 26 millions; in 1870, nearly 28 millions; it is not likely to be less; and the iron ores of the middle Lias of Cleveland are scarcely yet opened out, and they, like the coal, are almost inexhaustible.

Scotch Coal-Fields.

The peculiarity and value of the Scotch coals and the physical condition of the coal-fields are so important in any inquiry bearing upon the question of their geology, especially economically, that it is impossible to pass over such areas as the Clyde basin, Mid-Lothian, and Haddington and also Brora, most of them differing in many respects from the English deposits.

The carboniferous rocks of Scotland cross the country from south-west to north-east, and stretch from sea to sea—from Ayr to the Firth of Forth—occupying the great synclinal hollow or trough along the valley, and parallel to the chains of the Grampians and Lammermuirs, or between the slopes of the Grampians and the north flanks of the southern uplands. This great hollow or depression is filled with a coal-field nearly 100 miles long, extending from St. Andrew's, near Greenock, and from Dalkeith to Ayr, and about 25 miles broad. This great range is not all productive of coal, hence they form several distinct fields or basins naturally, divisible into six—viz., the coal-field of the Clyde basin, the Mid-Lothian, Edinburgh, and Haddington coal-field in one, and the Fifeshire, Clackmann, Ayrshire, and Lesmahago. The greater part of the workable coal series of the Scottish area is included in the Carboniferous Limestone group, for the English Lower Carboniferous rocks undergo a gradual physical change in their extension from south to north, or from the Midland Counties into Northumberland and South Berwickshire, and coal seams occur in, and are worked in them near the base, associated with thick beds of shale, the calcareous beds having greatly diminished. Below the equivalents of our Carboniferous Limestone are a series of white and grey sandstones, shales, cement stones, and thin coal seams. These equal the English Lower Limestone shales, and are termed "calciferous sandstones," which sometimes attains a thickness of 4000 feet.

Clyde Basin Coal-Field.

This magnificent coal-field, which includes the greater part of four counties is traversed throughout its entire length by the Clyde. The coal-bearing series of Lanarkshire are 4000 feet thick, divided into upper, middle, and lower, and respectively 840, 960, and 2200 feet thick, the base of the whole being the calciferous sandstone. The upper and lower series are the chief coal-bearing groups. The upper has 10 seams of coal above 2 feet thick, and three valuable bands of ironstone. The lower series contain valuable beds of coal, and three courses of black-band ironstone. "West of Glasgow, the black-band ironstones occasionally pass into coal seams, the carbonaceous matter gradually replacing the argillacious carbonate of iron." (Hull.)

Valuable beds of cannel and oil shales occur west and south of Glasgow, and the far-famed "Boghead" brown cannel, or parrot coal, the richest in oil and solid paraffin in Scotland, is 20 inches thick, resting upon a bed of fire-clay (under-clay), with Stigmaria ficoides ramifying through the under-clay—conclusive evidence of this coal, like all other seams, having accumulated on the spot now worked. The small and detached basin of Lesmahago contains, and is celebrated for its rich cannel or gas coal, near the base of the limestones, and may be the same as the Glasgow series. This Boghead cannel yields 13,500 feet of gas per ton, with an illuminating power of 28 candles, 36 per cent. of coke and ash, and 20 per cent. of hydrocarbon. This remarkable variety of coal occurs also at Torbane, Inchcross, Bathvale (near Bathgate), Rocksoles (near Airdrie), Pirnie, Kirkness, and Wemyss, in Fife; also in the county of Linlithgow, where it reaches 30 inches in thickness. Close and compact cement-stone and shale compose the roof of this coal. The produce is about 100,000 tons per annum. Marine fossils occur in the black-band ironstone and oil shales which occasionally overlie the cannel.* Mr. J. Young, of Glasgow,† has given most detailed lists of fossils from the carboniferous rocks of the Clyde basin. The upper series contain both fresh-water and marine fossils; the lower series are entirely marine, and are rich in fish, mollusca of each class, and other invertebrata.

Mid-Lothian, Edinburgh, and Haddington Coal-Fields.

The proximity of this triple field to the Scotch metropolis, and its now isolated position on the south-western side of the Firth of Forth, the water of which divides it from the Fifeshire field, adds or gives interest to its otherwise great value, geographically or physically, as well as economically. This and the Fifeshire coal area are the most interesting of all the Scotch fields; the great beds, sheets, or flows of contemporaneous and intrusive trap rocks, with their effects or action upon the associated carboniferous sandstones, limestones, coals, and shale, must be seen to be understood.‡ But general geology I cannot here enter into. There are in this field nearly 50 coal seams, varying from 1 foot to 13 feet each, and having an aggregate of 120 feet of coal. Famous or celebrated amongst other coals are the 8-feet "great seam" and the "North Greens," the latter being 1500 feet below the "great seam," and yields the well-known "Parrot" 3-feet coal, so highly esteemed for its gas. Both these seams occur in the Carboniferous Limestone, which is here 1600 feet thick, and containing 17 workable coals; the coal measures proper, above, with 11 seams, being 1220 feet, and with the millstone-grit at the base. The East Lothian field, 30 miles square, with 10 seams of coal, is composed entirely of the Carboniferous Limestone series, which encircles the field on the east and south-east, and the coals and ironstones throughout are the equivalents of the "edge coals" of the Mid-Lothian; the "calciferous sandstones" and the Burdie House, or Queensferry limestone, with its rich fauna and flora, underlies the limestone group. Volcanic ashes and associated contemporaneous igneous rocks accompany the "calciferous" beds. More remarkable still is the *Fifeshire Coal-Field*, on the north side of the Firth of Forth. Gas, steam, iron-smelting, and anthracite coal seams, 29 in number, and of high quality, range through the measures, and enter the sea near Kirkcaldy.§ At Burntisland and along the coast eastward, associated with the calciferous beds, are to be seen and examined the "necks, or remnants, of old submarine volcanoes, which (perhaps during miocene times) poured forth their molten lavas near the sea bottom or bed, and vomited forth showers of ashes, stones, and blocks, even now to be identified, as isolated bosses of basalt, tuff, and agglomerate." (Professor A. Grikie, F.R.S., Address to British Association, Dundee, 1867.)

The Ayrshire coal-field, separated from the Clyde by the Dunlop Hills, and Trappean and Devonian Rocks, is a rich and productive area; "much, however, of the minerals have been destroyed through the agency of intrusive igneous masses, and dykes of dolerite and basalt, which also interferes with the prosecution of mining operations," about 35 feet of coal, and much black-band ironstone occurs, chiefly in the lower part of the coal measures and the limestone series.

Lastly, I may say a few words relative to the little isolated and abnormal coal-field of Brora, on the east coast of Scotland, on the shores of Domoch Frith, and near Golspie and Dunrobbin Castle, the seat of His Grace the Duke of Sutherland. The age of this coal and its associated strata has often been discussed. There cannot, however, be any doubt, but that the coal seam itself is of lower Oolitic age, and the roof of the seam, the bottom of the middle Oolite or Kellaway rock; it contains a fauna referable only to this horizon, being purely marine, and containing 60 known species of fossils. The main bed of coal is from 2 feet 6 inches or 3 feet to 3 feet 6 inches thick, and rests upon beds of black carbonaceous shales, containing thinner seams of coal, or coaly matter, and yields good oil. The series of shales, &c., below the coal seam, are estuarine and inconstant in character. Many fresh-water and estuarine shells, such as Unio, Cyrena, Ostrea, &c., were obtained, and crushed stems of "*Equisetites columnaris*," were abundant through the coal;‖ no other plant was observed. The spirited manner in which His Grace has reopened, and is now working this remote "oasis," deserves all success. It is indeed a boon to the people and industry of that district. The area and future resources are not yet definitely known.¶ The coal was first worked and the pit opened in 1598 by the then Countess of Sutherland; it was discontinued in 1832.

We thus see that the gological age of the Scottish coal-fields and coals was earlier in time, or Scotland was an old estuarine land surface prior to most of the accumulations and coal growths more to the south; or, in other words, much of the north, middle, and *west of England was depressed* beneath the seas of that age, *when* the Clyde field, the Lothians, Edinburgh, and Haddington series, 1200 feet thick and 12 seams of coal; the Fifeshire coal-field, with its 21-feet Dysart seam, and three others 10 feet thick; also the Clackmannan shales, with the gas, parrot, and iron-smelting coals, *were probably in existence.*

The Coal and Coal-Fields of Ireland.

Little can be said relative to the coal of Ireland now, as compared with the richer stores of England and Scotland. The time was when Ireland was two-thirds covered; now, only a few (six) isolated tracts or outliers are left as evidences of former wealth, nearly all the coal measures having been denuded from the Limestone, and other "bases," leaving the great central Limestone plain of Ireland beneath the drift, a now coalless tract. The six isolated little coal-fields in Ireland—Antrim, Dungannon, Tipperary, Tyrone, Kilkenny, and Clare—are remnants of a once widely spread and extensive formation, the lower portion only being left. In the south of Ireland, about Cork, the coal measures are almost the same in section as those at the western extremity of South Wales, and the coal of this southern district is chiefly anthracite, whereas those of the north of Ireland, Tyrone, and Ballycastle, are bituminous, like the north of England. All the Irish collieries united, about 40 in number, do not yield more than 130,000 tons per annum; the net available coal left for future use, in Ireland, is estimated at 182 millions of tons. There is a greater produce of anthracite raised than bituminous. The peat of the bogs may yet be converted into coke. It is unsurpassed in extent and quality. Until then the Clyde, the Mersey, the Dee, and Whitehaven, will not allow Ireland to want in coal.

* Professor W. W. Smyth, F.R.S., "Coal and Coal Mining," p. 48.

† *Vide* Wood, "Trans. Nat. Hist. Soc., Northumberland," vol. i.; also Hutton, *ibid*, vol. ii., p. 24.

* Grossart, "On the Upper Coal Measures of Lancashire," Trans. Geol. Soc. Glasgow, vol. iii.

† *Ibid*, vol. i., pt. i., p. 53.

‡ Consult the able memoir upon this field by Messrs. Grikie and Howell, Mem. Geol. Survey Sheet.

§ Langdale, "Transactions of the Highland Society," vol. xii.; Hull, "Coal-Fields," &c., p. 286.

‖ I spent two hours underground examining into the details of the present and old workings. The richly fossiliferous roof, crowded with upper Oolite fossils in vast quantities, and the Estuarine floor, I shall never forget.

¶ The statement that 70 millions of tons have been extracted from the old workings must be an error.

Coal under the Newer Rocks, or Concealed Coal-Fields.

Few questions are of more vital importance to the future of England than the stores of coal at her command; to none more than those engaged in pursuits which demand, and must command, unlimited quantities, and that with some limit as to cost. This question of the extension of our coal-fields, and the limit in depth to which coal-mining could be safely and economically or profitably carried down, or the physical limits to deep mining, engaged the serious attention of the Royal Commission. To each of these important questions, I will ask your attention.

I have stated that we have both exposed and concealed coal-fields throughout certain parts of England. The term exposed, or visible, being applied to those tracts where the coal measures come to, or are exposed at, the surface without any superincumbent and newer strata to cover them. This may be attributed to two causes—first, by elevation from below, through forces acting from within; secondly, by the removal of overlying strata by denudation, so as to expose the older, or those on which they rest, these latter being the concealed. The great South Wales field and the Forest of Dean are fair examples of exposed or visible coal-fields; the Somersetshire, part of the Leicestershire, and eastern part of the Northumberland and Durham under the sea, the area between the Warwickshire and South Staffordshire coal-fields, Cheshire, and the Severn Valley, &c., are examples of concealed fields. The Permian and Trias Red Rocks are those which mostly overlie or cover up these concealed reservoirs. Our knowledge of the extent of these subterranean resources has of late years considerably advanced, owing to more exact research into the physical geology of the British Islands. For the clear understanding and solution of this problem, it is necessary to know and to restore the original limits or margin of the carboniferous rocks at the time of deposition, and also the directions of the axes of disturbance (upheaval and depression) along which the subsequent terrestrial movements have taken place, and also the amount of denudation the overlying and also *now* concealed rocks may have undergone. The investigation made by the Geological Survey afforded and supplied much of the necessary details for the consideration of this complex problem. Professor Ramsay, LL.D., &c., one of the commissioners, was requested to draw up this portion of the report, his intimate knowledge of the physical structure of England eminently qualifying him for the task. Professor Edward Hull, F.R.S., has contributed more to our knowledge of the structure of the Midland and Northern districts, and the coal-fields generally, than any living author; and his views, with those of Professor Ramsay, upon the probable subterranean limits of the coal-fields, are accepted as bases for calculation. Mr. Godwin Austin, F.R.S., Professor Prestwich, F.R.S., the late Professors Jukes and Phillips are prominent, amongst others, for original views and close investigation relative to the old extension and accumulation of coal over the British Isles.

Investigation shows that extensive tracts of coal exist under the Permian and New Red Sandstone, and in some places other superincumbent strata, in districts hitherto unknown or unproved. The area of concealed coal-fields calculated for is 2947 square miles, and the quantity of coal within this area, down to the allowed *and prescribed depth of* 4000 *feet* (as limit of working), is 56,273 million tons, 40 per cent. being allowed for loss, waste, and contingencies. The quantity of coal beneath the same rocks at depths *exceeding* 4000 *feet*, and occupying 843 square miles, is computed to be 41,144 million tons, of this quantity about 29,000 million tons are assumed to lie at depths between 4000 and 6000 feet.* The remainder, over 15,000 million tons, is assumed to lie at depths between 6000 feet and 10,000 feet, at which depth the temperature would be 215° Fahr., or 3° above boiling point. To the above are to be added 7320 million tons as being at greater depths than 4000 feet, *within the areas of known coal-fields*. This gives us a total quantity of coal lying at depths exceeding 4000 feet of 48,465 million tons. It is a matter of conjecture whether any or what portion of this coal can ever be worked: if not, it is lost to use.† Large as these items and amounts may appear to those who have not looked into the question, they are, nevertheless, not over estimated, and were prepared with scrupulous care.

Estimated Quantity of Available Coal in the British Islands.

I must refer those who would examine into this question in detail to the volume of the commissions, where every item is stated and the results tabulated; of necessity I am obliged to make free use of these statistics and results, so as to lay before you in a clearer way the history of coal associated with its geology.

Adopting, then, the limit of 4000 feet as the practical working depth,‡ we have in *our visible* coal-fields available coal to the amount of 90,297 million tons. This great item is derived from the 17 coal-fields in England, 16 in Scotland, and 6 in Ireland; or—

England	80,207,939,468	tons.
Scotland	9,843,455,930	„
Ireland	155,680,000	„

The *concealed coal measures* or coal-fields contain, to the same depth, 56,273 million tons, making a total of 146,480 million tons of available coal. From this total we deduct, for seams under 2 feet in thickness, 1-20th, or 7324 million; thus leaving for future use 139,156 million tons of fuel. The demand or yield is now nearly 120 million tons per annum. At this rate of consumption we have coal enough to last us over 1200 years.

This brings us to the consideration of the *probable duration of our coal*—a momentous question for England and the future prosperity of her people. It has occupied the minds of physicists, mathematicians, statisticians, and statesmen. The commissioners report deals largely with this question in all its bearings—viz., waste of fuel by bad working and combustion, manufactures, economy, population, &c.§ "Practicably inexhaustible" is now a hackneyed phrase, especially so in the face of facts and surveys, which determine and have determined the exact boundaries of certain of our best defined coal-fields and limits of its stores. Doubtless the question of the exhaustibility of our coal-fields is a highly complicated one, the whole turning upon consumption, supply and demand, and time. We have so much supply, and no more. Largely are we now drawing upon the reserves of our "national bank." Yearly, 120 millions of tons are withdrawn. None is returned or capitalized. No reproduction takes place, for "coal is no longer forming; and be it remembered that we are exhausting about 20 square miles of fuel every year, and working away 5 acres of coal, 2 feet thick, every hour, night and day, or 1¼ acre every quarter of an hour." This in the face of no substitute, no reproduction. "We are drawing," says Mr. Jevons, in his book on the coal question, "more and more upon a capital which yields no annual interest, but, once turned to light, and heat, and force, is gone into space for ever." Two of the greatest branches of British industry demanding a constant and immediate suitable supply of coal, and that of a special chemical nature, are gas-making and iron-smelting and manufacturing. For the purposes of gas-making alone nearly 4 million tons are used or consumed annually in Britain. We may ask how much for the production of steam power, the smelting of ores, locomotion by sea and land, the lighting of how many cities, and warming how many houses? It is as "necessary to social life as food to man," and yet we are reckless and lavish, if not wasteful, in its use. It is also a questionable and doubtful policy to use or adopt unlimited freedom in the export of coal, thus draining our natural, as well as national resources, of a power possessed by few European States.*

Free trade in a commodity not reproducible (not manufactured), and which, when once consumed, cannot be replaced, is an error. These stores were laid down atom by atom in the course of natural laws and causes, and took countless ages in preparation; and we, as a people, fortunately occupy one of those rich areas on the earth's surface which holds this priceless gift from nature, the result of natural laws, under Eternal guidance and Infinite power. At the commencement of this century the quantity of coal raised did not exceed 10 millions of tons; it is now nearly 120 millions, and in all directions there is still an augmenting demand upon our coal resources. The increase of population alone is an item so insinuating and certain, that it is evident, at no distant period, coal enough cannot be obtained for the wants of society, especially so, if our population increases in geometrical ratio, whilst the deposit or future store of coal does not at all increase. It is manifest that the operation of combined causes must tend to increase, rather than decrease, the demand for coal. It is estimated by some that in five years hence our extraction will, or may be, 130 millions of tons per year, thus doubling the output in 20 years. Mr. Jevons,† adopting 1865 as a standard of consumption (then 95 millions of tons) estimated 3½ per cent. as the rate of extraction or demand, or reckoned each annual per centage on the previous year's consumption at the above ratio.‡ For years it has been about 4 per cent. Bear in mind we have become the coal granary, the reserve, the working or producing coal-field for the world; and out of the 200 millions of tons supposed to be extracted yearly from all the coal-fields of the globe, we are raising 120 million, or more than one-half.

In 1860, Mr. Hull, on an output of 73 millions, and a reserve of 80,000 millions, believed that our coal would last 1000 years. The commission, ten years after (1870), returned the store at 146,480 millions of tons§ (nearly double Mr. Hull's estimate). Mr. Jevons endeavours to show that "all improvements in the economizing of labour has resulted in an increase in the consumption of coal, and contends that coal, being the source of power, and required for every extension of industry, the consumption of it will keep pace with the progress of population and the extension of manufactures and industrial pursuits."‖ Mr. Pryce Williams, employed by the commissions, for reasons stated in the report (vol. i., p. 15), concluded that the rate of increase of coal used per head of the population follows a *diminishing ratio* according to a certain law. On this basis, Mr. Williams calculates that at the end of 100 years the annual consumption will be 274 millions of tons, and the known quantity will last us 360 years. Mr. Hunt, of the Mining Record Office, and others, believe that the population and manufactures of the country have nearly attained their maximum. In this case our coal supply may last for about 1270 years. Economy and scientific application are the anchors of safety. A Royal Commission devoted to the question of waste and economy would elicit strange facts, and perhaps suggest the adoption of stringent rules for our trusteeship, as guardians for our descendants.

Possible Depth for Working Coal; or Physical Limits to Deep Mining.

It is well known that many portions of our coal-fields lie at greater depths than have yet been reached in mining, or through any other mode of testing the vertical capabilities of their resources. This is the case with the centre of the Bristol coal-field, both north and south; and many others, especially those having much overlie, or covered up by newer rocks, such as the Permian, Trias, and, in places, the Lias. Again, those coal-fields having extensive areas, and which are not much disturbed by faults or movements along either their major or minor axes, are frequently deep; deeper, indeed, than modern appliances have been brought to bear upon the penetration and extraction of coals below 3000 feet. This important question and feature in the future history of our coal supply received great attention from the commission, and much evidence was taken and elicited relative to the extraction of coal to the depth of 4000 feet, and if any, and how much, occurred, and was available below that depth. The result in evidence was highly favourable so far as quantity was concerned. It being shown that in the British coal-fields *below the* calculated maximum depth at which it was safe to estimate for, we had reserves to the extent of over 48,000 millions of tons; this quantity ranging between 4000 and 6000 feet. We believe that 4000 feet may be reached and worked with safety.¶ The two agencies which operate with the greatest energy and certainty as we descend virtically from the surface are "temperature and pressure," and they are the chief obstacles with present appliances now limiting the practicable depth of working our coal.

In other words, increase of temperature, which accompanies increase of depth, is the chief natural limiting cause. At 2500 feet the mean temperature reaches 90°, about tropical heat, which, unless considerably ventilated and reduced by artificial means, is a source of waste of power and energy. The conclusion come to by the commission was to the effect that the workable depth of coal mines depends upon human endurance of high temperature, and the possibility of reducing the temperature of the air in contact with heated strata. Labour is not practicable in moist air at the temperature of the blood, or 98°; at 3000 feet the temperature equals this, which, added to the humid condition of the air along the working faces of the coal, renders labour irksome and dangerous. It is found that under the "long wall system of working, a difference of temperature, amounting to 7°, exists between the temperature of the air and the coal-face; hence, by this system we gain 400 feet in depth for the same temperature of 98°; or at a depth of 3400 feet under the long wall system the temperature is the same as that at 3000 feet with the cellular, or pillar, or post and stall system."** The rate of increase of temperature in our coal-mines is 1° Fahr. for every 60 feet in depth. At the Rose Bridge coal-pit, near Wigan, the shaft is nearly 2500 feet deep; down to 1800 feet the ratio of 1° per 60 feet held good; it then became more rapid, and at 2376 feet the thermometer stood at 92° Fahr. It thus appears that, at the depth of 3420 feet, the temperature of the air would equal that of the blood. Beyond this temperature, no matter what depth, labour would be almost impossible, especially so in moist air.†† The influence of pressure is more difficult to realize; but in coal mining, as distinguished from "mineral veins," it must seriously operate, owing to its force being always vertical, and existing over a plane whether horizontal or inclined, and usually of great extent. The accumulative weight of 3000 or 4000 feet of dense strata per square yard, or mile, upon some coals, or their roof, when removed, or the softer underclays and roadways, &c., underground, must be enormous, and difficult to deal with; increased density of the coal seams

* At 6000 feet the temperature of the earth would exceed 150° Fahr; fatal, with modern appliances, to life and labour.

† Professor Ramsay, LL.D., "Royal Commission," vol. i.

‡ At present, in England, no workings exceed 2500 feet. Professor W. W. Smyth, from a communication from Professor Trosenster, of Liége, states that at Hainault (Belgium) coal is being worked at the depth of 2800 feet, and that one pit has been sunk 3411 feet.

§ See also "The Coal Question," by W. Stanley Jevons, 1865, a most important work on the duration of our coal supply.

* Our foreign shipments in 1871 were 12 million tons. France is our largest customer; in 1872 we sent her 2,200,000 tons. Her own annual extraction is about 14 millions of tons. Our domestic consumption is nearly 19 millions of tons.

† "On the Coal Question."

‡ He anticipated the returns of 1871 to be nearly 118 millions of tons. The official returns were 117,352,000—a close approximation.

§ This discrepancy was due to the Royal Commissioners having taken into account seams of coal under 2 feet thick, omitted by Mr. Hull, at great depths. Again, the hidden coal-fields were better understood.

‖ Under this view, the coal would be exhausted in 110 years.

¶ Professor W. W. Smyth is of opinion, from recent experience in deep mines, that the difficulty of temperature may, by due appliances, be overcome to even a greater depth than 4000 feet.

** Hull, *loc. cit.*, p. 435.

†† In the "Copper United Mines," St. Day's, Cornwall, the temperature at the bottom, in the Hot-Lode workings, is 114°, 117°, 120°. The men work 15 minutes at a time, or three hours daily.

themselves does not seem to be recognized or manifested. Cost is another element that may operate against winning deep coals; the fact of two shafts having to be constructed, *to no matter what depth*, is one amongst many other serious items, the increased cost of working, winding, wear and tear of machinery and materials another obstacle, and the deeper the pits the larger the united and greater all subsequent expenses: for, if it cost £100,000 to win coals at 2000 feet, 4000 feet would cost £300,000, and this before a ton of coal would be brought to bank. Few, *even now*, will attempt to win coal at such proportionate cost and risk. Again, the great outlay of capital involved in winning coal at great depths renders it necessary to possess and work large areas for each sinking, and, consequently, air courses of great length. Nevertheless, momentous results depend upon a constant supply of coal in Britain, for our commercial prosperity is founded upon its possession and use.

The Probabilities of Finding Coal under the newer Rocks of the South-east of England.

I have previously mentioned somewhat incidentally the probable extension of the Bristol coal-field east of its present defined line from Yate, south to Bath, and on to Frome and Mells, &c., on the eastern part of the Mendip range. All the eastern side of the coal-field between Bath and Frome is covered by rocks of Oolitic, Lias, and Triasic age; in other words, this portion is a concealed coal-field, all the upper coals at Radstock, near the centre of the field, being won through the overlying rocks, and at a depth of about 1200 feet. The Bristol, or Somerset and Gloucester, coal-field is by no means the most easterly in England, the Warwickshire, Leicestershire, and Nottingham fields being, meridionally, 100 miles more to the eastward. This, however, may arise from, or be due to, the strike or trend of the old land or coal-growing surface from N.E. to S.W. Therefore, geologically, it may still be as much east as the others. One thing is certain, we do not know any exposed Palæozoic rocks eastward of the field in the latitude of Bristol, or the Mendip Hills, all between this range and Belgium being covered by Mesozoic and Cainozoic rocks. To the south of the Mendips we have the Quantock Hills, and the Devonian series of West Somerset and North Devon, and south of that the widely spread but *barren coal-field* of Bideford and Bude, &c., which is due south of the great and productive exposed South Wales field, originally all one extended coal-growing (terrestrial or estuarine) surface. It is essential to particularize this south-western territory, it so intimately bears upon the possible extension of the British coal area to meet that of Valanciennes and France, under the south and south-eastern counties of England, where, however, there is no visible sign of such. Theoretically speaking, the coal-fields of England, France, and Belgium were once continuous. Probably, so under the Wealden of Sussex and Kent, it may be that the extensive area south of a line drawn from Harwich, Hertford, and Oxford to the English Channel, and across to the Boulonnais, was covered by Palæozoic rocks even older than the coal measures, possibly of Devonian age. No geologist (says Mr. Prestwich) now doubts but that beneath the south-east of England and the north-west of France there was a floor of Palæozoic rocks, the depth and range of which were wholly independent of the range of the Secondary and Tertiary rocks above. These two sets of rocks are perfectly independent one of the other, and the direction, range, and depth of the underlying Palæozoic rocks cannot be inferred from the bearing of the overlying secondary strata.* "Owing to the extended area over which research for coal has been made during the last century both in Belgium and the North of France. The range of these older or Palæozoic formations beneath the newer may be traced as far as the French coast, as at Calais and in the Boulonnais." Shafts sunk near Lille (in France). and at Harwich, both passed through Tertiary (Numulitic) and Cretacious formations, and both came down upon Palæozoic rocks, one (Lille)a limestone; that at Harwich on highly cleaved slates, with posidonomyæ, shells characteristic of the Carboniferous Limestone. Now "the distance from Boulogne to Harwich is about 85 miles, and from these places to Frome and the Mendip Mills 140 miles." What are the geological features of this interval? It is the opinion of R. G. Austen, Esq., that probably the Belgian coal tract which is continued along the axis of Artois into the Boulonnais is still further prolonged into England, across the south-eastern counties, into Somerset. Professor J. Prestwich† believes that the "overlying secondary rocks of the Wealden area do not exceed 1200 feet, and infers that the underground coal basin may have a length of 150 miles east and west, with a breadth of from two to eight miles. The direction of the great underground trough being probably on a line passing through North Wilts, Oxfordshire, Hertfordshire, South Essex, and the north-eastern extremity of Kent, onwards towards Calais;" "or in case of the anticlinal axis taking a more southerly course, we should look for the coal basin along a line passing from Radstock through the Vale of Pewsey, and thence along the North Downs to Folkestone and near to Calais.‡ Thus we see that the supposed physical structure of this area lends full confidence in the belief that we have the Palæozoic rocks below the south-east of England. Whether they will prove to be coal-bearing, or the coal measures, or rocks of Devonian age, like those of the Ardennes or North Devon, time only will tell, and then perhaps only through the sub-Wealden boring; we have no other test. Those of Harwich and Kentish Town go far to show that we must have the older rocks largely extended south of the Thames Valley.

Flora or Vegetation of the Coal Period and Carboniferous Epoch.

Sometimes called the age of plants, or period of gigantic vegetation; I do not know that either term is strictly applicable. Doubtless, of their kind, and, on the whole, as compared with the cryptogamous flora of the present day, the tree-like forms were large and luxuriant. If applied to the "gigantic" quantity, luxuriance, and universal distribution over the globe of the same genera and species, the term may well indeed be used, for we now know that nearly four-fifths of the plants of the coal (the carboniferous flora) are common to America and Europe, especially Nova Scotia; hence the probability of a former extension of land, continental, or islandic, or chain of islands now covered by the Atlantic. Many of the same genera and species range through Europe and America from the Arctic regions to 30° of latitude, or over a space occupying about 45° of latitudes, and lived on through time sufficiently long to accumulate vertically 10,000 and 12,000 feet of strata. Similarity of mechanical deposits are also confirmatory of like conditions. This, added to the agreement of the Nova Scotia fossil plants, and invertebrate forms of life with the Scotch fauna and flora, is at least suggestive, and points to the original connexion of the two continents through land surfaces, estuarine, and other conditions. Palæophytology, or the study of fossil botany, by the distinguished naturalists, Robert, Brown, Hutton, Lindley, Brongniart, Professor Balfour, Carruthers, Schimper, Dr. Dawson, Hooker, Sir C. Bunbury, and others, has indeed greatly added to our knowledge of the physical state of the earth at this particular age, and its climate at different epochs; and we are perhaps as intimately acquainted with the nature and history of this Palæozoic flora as with many portions of the living vegetation in certain regions of the globe. No less than 72 genera of fossil plants are known in our British carboniferous rocks alone, yet only a fragment of the plants of the coal period is left to us. Brongniart, and with him Dr. Balfour, recognizes three periods of vegetation in the extended history of the globe, which they term ages, characterized by the predominance of certain distinctive or dominant forms of plants. Thus the flora of the Primary or Palæozoic Period is termed the "Reign or Age of Accozens," so called from a great group of cellular and vascular cryptogamous plants, which greatly predominated during the early period of vegetation, now illustrated by the Ferns, equisitaceæ and lycopodeaceæ, or club mosses. These groups were arborescent in their habit, and were of gigantic proportions. Ferns greatly predominated during this period; some 20 fossil genera are recognized in Britain. The great tree ferns of to-day were shadowed forth by gigantic forms distributed through the coal measures. They appear the only carboniferous fossil group having any reliable relationship to those now living,* but pecopteris seems a fossil representative and close ally to our Pteris, and to Polynesian forms of the same genus. The lycopodeaceæ, chiefly met with in our coal measures, are Lepidodendron (its fruit lepidostrobus), Ulodendron, Knorria, Bothrodendron, &c., and the most abundant and important of all is the genus Sigillaria,† and its roots Stigmaria,‡ which ramifies through almost every underclay in all our coal-fields, and every coal-field in the world. Amongst the ferns the commonest and most typical are Neuropteris, Pecopteris, Odontopteris, Alethoptoris, Adiantites, Sphænopteris, &c., which occur in the shales of the roof of many coal seams, and in argillaceous iron nodules below and above the coal. The equisetaceæ, or horse-tails, common fossils under the name of Calamites and the rarer Volkmannia abound from top to bottom of the coal measures. They are gigantic fluted reed-like plants. The acicular, strap and wedge-shaped bodies in almost every shale roof, called Sphenophyllum, Asterophyllites, and Annularia, probably are or were the foliage of the genus Calamites. These, and many other great plants of the coal period, grew in dense masses over low-lying lands or regions, chiefly perhaps the deltas of large rivers, or estuaries slightly elevated above the sea level, and liable to submergence on slow or periodical oscillations of the land. Associated marine remains and occasionally fresh-water forms occur, and enormous thickness of strata of sandstone and shale, to which the coal is subordinate, fully attest the mode and site of accumulation, and clearly demonstrate that the vegetation, or flora, grew on the spot, where it became fossilized, and is now coal. Again, its microscopic structure, combustible properties, and position in the strata, demonstrates its vegetable origin, also the uniformity in the vegetation of the coal period, now no parallel. The peculiarity of the flora, or conditions of carbonization or subsequent metaphorism, give us new elements of difference or variety, rendering one seam of greater value than another for economical purposes. Hence it is that, in the same coal-field, we have superimposed, one upon the other, coals of different virtue, power, and uses, one suitable for the production of gas, or gas coal, another for the more rapid production of steam, or steam coals, another adapted for the smelting of iron, or furnace coals, others oil producers, some smokeless and pure in carbon, others, again, for domestic use, and some useless.§ Experience, through trial alone, has hitherto guided us to a knowledge of these various properties; what might have been done under strict chemical analysis for the adaptability of special coals we ought now to show by turning our utmost attention to the intrinsic use, power, and capability of every workable and rejected seam, for the time will come, and that shortly, when science only will enable us to save and economize our coal.

The nature of coal deposits is far too large a theme for our consideration here. Suffice it to say that, not only throughout Great Britain and Europe, but also in most other parts of the world, does the same uniformity of character exist, pointing to their contemporaneity. Everywhere is the underclay or natural soil beneath the seams of coal the same tough grey argillaceous clay, and everywhere containing the same plant Stigmaria; everywhere does the roof to the coal abound in plant remains (trees, leaves of ferns, fruit, &c.), and also ironstone nodules enclosing the fauna or flora of the area. These two elements alone in the structure of a coal seam—viz., the underclay with its ramifying roots, and the clearly defined top or roof to the coal—clearly show that the whole was laid down and carbonized on the same spot or land surface we now see it derived from, the growth, accumulation, and decay of vegetable matter, chemically changed.

What are we to say of time, so important an element in, and one of the chief agents employed in the production of our coal. Where or what is our standard whereby to estimate the growth and decay of these ancient forests? We have none, neither can we approximate it. The great Welsh coal-field, with its 10,000 or 12,000 feet of accumulated strata, its carbonized plants, and all their history and development, *is a measure of time;* and the vertical displacement the whole coal-field underwent in one geological period sufficient to bring the present summit of the Alps to the level of the sea—14,000 feet—*is another measure;* but by what given quantity or standard shall we or can we measure these long continued, slow, and certain operations governed by natural laws?

In conclusion, what may not be said of the power, virtue, uses, and products of coal—subjects as inexhaustible as the coal itself? Light and heat are simple words to utter, but what their import? Whence the origin of the light and heat giving power stored up in a ton or ounce of coal? When were those heat and light giving rays of the sun employed in fixing the carbon of those gases you now redistil in your retorts and issue for the use of man? What was the real nature of the flora and vegetation of that remote period, never surpassed in wonder, magnitude, and use? What the climate, the atmosphere, the life of the coal period? And what the hidden power, even then or at that remote epoch in the earth's history and condition of the globe, that prepared and stored up for the use of man this infinite wealth and power? These are problems and questions for the physicist, the naturalist, and the chemist, *yet to be solved and answered by patient and modest research.* Lastly, gentlemen, who will deal with time, and tell us the birth and infancy, the coming in, the dawn and morning of that period we call the coal measures, the Flora of whose forests flourished, culminated, and became carbonized over what are now the fair yet busy plains of Britain?

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* This problem, it is to be hoped, will be solved by the deep experimental boring in the weald at Netherfield, near Battle, now down 1100 feet, but in the middle Oolitic rocks.

† Lately selected to succeed Professor Phillips as Professor of Geology in the University of Oxford.

‡ Diagrams showing these views were exhibited, and the connexion of England and the Continent.

* They are referred to the fossil genus Caulopteris. Psaronius was probably a tree fern.

† Many occur as lofty trees, 40 to 60 feet in height, with a diameter of 4 to 5 feet. Many still stand erect in our coal measures, passing through shales, sandstones, and clays, which accumulated around them when living.

‡ To Mr. Binney, of Manchester, is due the determination that stigmaria is the root of sigillaria.

§ The peculiarities of a particular coal in Yorkshire, the "Better-bed" at Bradford, and another from the Moira area were shown as examples of structure and contents only lately clearly determined. These coals are largely made up of sporangia and spores, shed from the cones of the genus Flemingites, and which constitutes a large mass of the deposit. Professors Morris and Fleming had previously, many years since, noticed the same bodies in other coals, English and Scotch. Principal Dawson, of Montreal, has examined 80 coal seams in Nova Scotia. He recognized these bodies in 16 seams. The "white coal" of Australia is entirely composed of similar bodies—this was shown also. Sir C. Lyell has figured these macrospores and microspores in the new edition of his "Student's Geology," p. 405. They are remarkable objects unmagnified.

LAUNCH OF MR. HULETT'S LIFEBOAT.—It was stated some time ago, in the JOURNAL, that Mr. D. Hulett, of Holborn, had generously presented a new lifeboat, with all the necessary appendages, to the Dungeness station, and we have now the pleasure to record the successful launch of the boat, which took place on the 21st inst., in the presence of a numerous and representative assembly. The day was observed as a holiday by the inhabitants of Lydd, and there were great rejoicings throughout the neighbourhood. Mr. Hulett has not only paid for the boat, but has also built an admirable boat-house at a cost of £286; indeed, he has found the whole of the money necessary for the establishment of the station, amounting altogether to about £750.

PELOUZE AND AUDOUIN'S IMPROVED PROCESS FOR ELIMINATING THE SOLUBLE PRINCIPLES CONTAINED IN GASES AND VAPOURS.

Letters patent have just been granted to Mr. A. M. Clark, of Chancery Lane, London, for an invention communicated to him by Messrs. Pélouze and Audouin, of Paris, for the above invention, the description of which we extract from the specification filed on the 23rd of July last.

This invention relates to an improved method of eliminating the soluble principles contained in gases or vapours by the reaction of liquid solvents put in suspension therein in a vesicular or molecular form. The greater number of the soluble gaseous principles existing in a free state or mixed with inert gases may be eliminated without difficulty when operating in the laboratory and on small quantities only, but it is entirely different in practice, when it is required to operate on large volumes of gaseous matters ordinarily containing but a very small proportion of the principles to be eliminated. Moreover, there is a liability in certain cases of the dissolvent acting prejudicially (if employed in too large a proportion) on certain principles, which it is essential not to separate, deteriorating the illuminating power of the gas by the dissolution of the bicarburetted hydrogen.

The apparatus now employed for producing the reaction of a liquid dissolvent on gases to be purified may be classed under two heads, viz.,—1. Those in which the gas under the form of jets or thin streams is brought into contact with the liquid dissolvent contained in a specially arranged series of vessels, such as Mallet's washing apparatus, archimedian screw apparatus, Colladon's apparatus, and others which are well known. 2. Those on which the gaseous mixture is caused to act on thin films of liquid distributed over solid surfaces arranged in a tortuous or labyrinthine manner, such as coke or furze columns or scrubbers and others.

Many ingenious arrangements have also been proposed for uniformly distributing the liquid employed as a solvent (such as a jet projected against a fixed surface, a chemical cascade, a rose, a Barker's mill, and others), and which have in certain cases produced good results, but they all occupy considerable space, and, besides being very expensive to work, necessitate the employment of an amount of liquid entirely out of proportion to the results obtained.

By the present invention a very efficient action is obtained under conditions which ensure absolute regularity.

The liquid to be employed for reacting on the gases and gaseous mixtures is introduced in the form of fine spray, which is carried away by the gaseous current, the intimate contact obtained under these conditions taking effect while the gas is passing through the pipes.

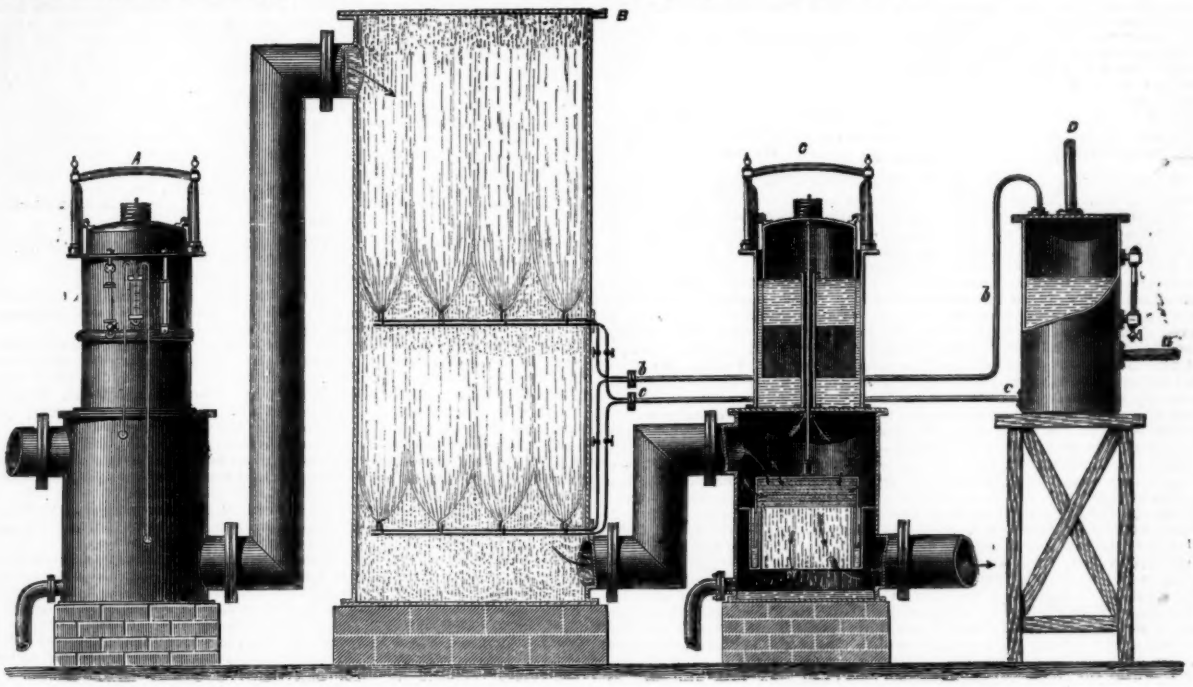
In certain cases the reaction may be brought about by retaining the gases in chambers of suitable capacity. This mist formed of fine impalpable spray would, however, only be eliminated again after a very lengthened traverse, which in many cases would be a serious objection, except by the aid of the condensing apparatus forming the subject of letters patent bearing date Jan. 10, 1873, No. 109, which apparatus unites the liquefiable globules in fine streams, and so effects their condensation. The use of this condensing apparatus has the twofold advantage—(1), of rendering the reaction more complete by more intimately mixing the liquids put in suspension in a vesicular form, and the soluble principles contained in the gases or vapours; and (2) of rendering the said gases or vapours perfectly dry and free from the liquid particles.

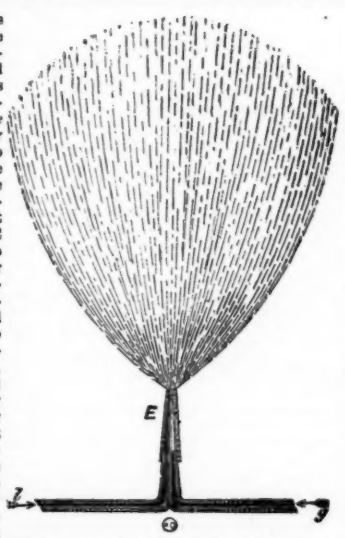
It should be added that by the improved process of this invention, an intimate contact between the molecules being obtained, no more liquid is employed than is absolutely required to produce the result desired, the liquid being carried along by the gases or vapours themselves.

The scrubber cylinders of gas-works may be utilized for carrying out this improved process, in which case it would be necessary for them to be superposed in order to obtain a column of from 40 to 50 feet in height.

Under these conditions, and when the gas has to traverse a considerable length of pipe before reaching the purifiers, it is not absolutely necessary to place at the outlet a condenser of the kind before alluded to, since the major part of the water which falls in the form of spray will be retained during the traverse through the pipes.

In the accompanying drawings is illustrated one arrangement of apparatus especially adapted for use in gas-works.





A is the condensing apparatus (before referred to as being the subject of a former patent) for eliminating the tarry matters carried along with the gas before it enters the chamber B, in which the soluble principles are dissolved by the intimate contact of the gases or vapour with the liquid reduced to fine spray. The number of the jets will vary according to the size of the works, one jet being sufficient to produce a permanent column of mist of from 24 to 32 inches in diameter, and from 10 to 13 feet in height, at the rate per hour of two gallons of liquid, mixing with 35 cubic feet of gas introduced under pressure. C, second condensing apparatus, similar to A, for retaining tlhe iquid dissolvents (water, ammoniacal, saline, or other liquor employed), and which is carried along in a globular form with the gas. D, reservoir containing the liquid dissolvent filled by a pipe *a*. It is also supplied with gas, which passes thence by pipe *b* to the nozzles or spray-producers. The gas being under a pressure of about 3 or 4 atmospheres, acts at the same time on the liquid in the reservoir, and which is conveyed to the nozzles by pipe *c*. E shows a section of the nozzles or spray-producers on a larger scale; *g*, gas inlet; *l*, liquid inlet.

BRISTOL WATER-WORKS COMPANY.—The directors, at their usual fortnightly meeting, held on Saturday, Sept. 18, resolved to declare an intermediate dividend for the half year to the 30th of June on the £25 and £20 (£4 paid) ordinary shares at the rate of 10 per cent. per annum, payable on the 15th of October.

METROPOLIS GAS SUPPLY.

METROPOLITAN BOARD OF WORKS.

The first meeting of the Board since the recess was held on Friday last—Colonel Sir J. M. HOGG, M.P., in the chair.

The CLERK (Mr. Wakefield) read a letter which had been received from the Board of Trade, transmitting for this board's observations copy of an application by The Gaslight and Coke Company for authority to lay down a new main through the parish of St. George, Hanover Square, and a statement by the vestry of their reasons for objecting to the application; and a further letter from the Board of Trade, stating that, unless they receive objections of this board by the 26th inst. to the company laying down the new main, they will give the company the necessary authority for that purpose.

The SOLICITOR (Mr. Smith), in answer to Mr. H. L. TAYLOR, said he had looked very carefully at the Act of Parliament, and it appeared to him that the board had no power at all in the matter. The board had no power whatever to stop the works.

Mr. NEWTON said they were not asked to stop the works; they were merely asked by the Board of Trade for their advice in the matter.

The ENGINEER (Sir J. Bazalgette), in answer to Mr. RICHARDSON, said the line of main referred to was the same as that which the company had applied to this board for permission to lay down under the Embankment. The matter would come before the Works Committee on the following Monday. The company proposed to go in the subway of the Embankment.

Mr. NEWTON said he thought the board should communicate those facts to the Board of Trade, and ask them to defer their decision on the application of the company until the board had come to a resolution on the application with regard to the Embankment. He moved a resolution to that effect.

Mr. LESLIE did not think the board should come to any decision upon this question until every member had had an opportunity of reading the report just issued by The Gaslight and Coke Company, in which they stated that they did not intend to apply for a revision of price for 1875, but would accept the normal price in their Act of 3*s.* 9*d.* per 1000 feet. That was a reduction throughout the whole of the district of 1*s.* 3*d.* It was said that a 3-feet main was a very large one, but the board should not forget what they were going to gain by having it laid. The Westminster and Blackfriars stations of the gas company were to be discontinued, and the money received by the sale of the land now occupied by those stations would go towards a reduction in the price of gas. The company had removed their works to Beckton, and large mains would be required for conveying the gas from those works to the parish of St. George, Hanover Square, a distance of 10 miles. The consumer, however, was to be

benefited, as the gas could be thus sent at a much lower pressure. His parish at present was very well supplied, but he thought the supply would be improved if larger mains were laid down.

Mr. BRUSHFIELD said large mains would not save the consumer anything at all, but they would benefit the company, as there would be no necessity to put on a heavy pressure.

Mr. H. L. TAYLOR was of opinion that the real object of this application was to perpetuate the present monopoly of the company.

The motion was then put and carried.

METROPOLIS WATER SUPPLY.

The following are the returns of the Society of Medical Officers of Health on the composition and quality of the metropolitan waters in September, 1874:—

Names of Water Companies.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitrogen.		Hardness.	
			As Nitrates, &c.	As Ammonia.	Before Boiling.	After Boiling.
Thames Water Companies.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Grand Junction	16·97	0·057	0·146	0·002	13·8	3·3
West Middlesex	16·27	0·026	0·147	0·000	13·2	3·2
Southwark and Vauxhall	17·43	0·055	0·115	0·001	13·9	3·3
Chelsea	17·07	0·053	0·113	0·001	13·8	3·3
Lambeth	17·30	0·050	0·147	0·001	13·8	3·3
Other Companies.						
Kent	27·60	0·004	0·248	0·000	20·4	5·6
New River	17·33	0·011	0·115	0·000	14·0	3·6
East London	15·33	0·041	0·148	0·001	13·0	3·0

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it.

The water was found to be clear and nearly colourless in all cases but the following, when it was very slightly turbid—namely, in those of the Grand Junction, Southwark and Vauxhall, the Lambeth and the Chelsea Companies. The average quantity of water supplied daily to the metropolis during the preceding month was, according to the returns of the water companies to the Society of Medical Officers of Health, 127,649,728 gallons; and the number of houses supplied was 512,540. This is at the rate of 37·5 gallons per head of the population daily.

HY. LETHEBY, M.B.

Major Bolton's report for the month of August states that the condition of the river at Hampton, Molesey, and Sunbury, where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, and East London Companies are situated, was very good throughout the month. The highest flood state of the river at Hampton during the month was 1 inch below the (6 feet) summer level, and the lowest 5 inches. At Ditton the state of the water in the river was good during the month. The Chelsea Company is now the only one whose intake is below Hampton Court Bridge. The highest state of the flood water at this place was 4 inches above, and the lowest 1 inch below summer level. The highest temperature of the water during the month was 67°, and the lowest 61°, while the highest temperature of the air at the same place was 75°, and the lowest 63°. These observations were made daily at 9 a.m. The rainfall during the month was 1·45 inches. The water at the Thames intakes was generally very good during the month. The West Middlesex Company is the only Thames Company at present which, having large reservoir capacity, avoids taking in water during floods. The Lambeth Company are making large subsiding reservoirs at Molesey, and the construction of additional subsiding and impounding reservoirs by the Chelsea, Grand Junction, and Southwark and Vauxhall Companies is desirable. The Kent Company have considerably extended the constant supply in their district, in pursuance of the provisions of the Metropolis Water Act, 1871. They now give a constant supply of water to that part of the company's water limits comprised within the parish of St. Nicholas, Plumstead, in accordance with notice duly given. This district includes about 2700 houses. A new covered reservoir is in course of construction at New Cross to hold about 1,750,000 gallons to provide for efficient constant supply to the Peckham district. The New River Company have the power of affording effective constant service in their district. They have also erected a new high service covered reservoir to contain 1 million gallons at Southgate, and have laid the mains in connexion therewith, in anticipation of the requirements of the water supply to Edmonton parish. This company have in a number of cases afforded constant supply by means of stand-pipes to a large number of the houses of the poor situated in courts within the City bounds. The East London Company have completed the extension of the constant system of supply in their district to the densely populated area mentioned in previous reports, containing upwards of 3000 houses, and the company retain their previously announced intention of bringing their whole district, section by section, under constant supply. The Southwark and Vauxhall Company have completed the new covered service reservoirs at Nunhead, to contain 18 million gallons, and progress has been made in laying the mains for distribution from the new reservoirs to the lower district, comprising Kent Road, Bermondsey, Rotherhithe New Road, Camberwell, and Peckham. Additional boilers and works are being constructed at Hampton, and the company are erecting additional engine power for high pressure constant supply, which will be shortly completed. The West Middlesex Company are giving constant supply to a number of houses on the application of the owners, who have provided fittings according to the Board of Trade regulations of the 10th of August, 1872, and are fully prepared to extend the constant supply when called upon. This company are constructing extensive works and additional engine power of 120-horse power at Hampton, to ensure effective constant supply. The Grand Junction Company have completed a high service reservoir near Kilburn, to contain 6 million gallons for constant supply, and are completing the line of main-pipes to connect up this reservoir with the works at Campden Hill; they are likewise erecting additional boilers and works at Hampton, for which place a new additional 70-inch engine of 125-horse power is being constructed, and an additional 30-inch main from Hampton to Kew has been ordered. The Lambeth Company are carrying out extensions and improvements in their works. At Molesey, the construction of one reservoir to contain 15 million gallons has been completed and taken into use. Two other reservoirs are in course of construction which, when finished, will contain together 110 million gallons. Pumping-engines to fill them to a level of 12 feet above the river are also being erected. When full these three reservoirs will contain 10 to 12 days winter supply to the district, and during the months when floods prevail (by selecting the times of pumping when the river water is in the best condition) a good deal of flood water will be allowed to pass, and several days subsidence will thus be provided for. This company are giving constant supply by means of stand-pipes in a number of courts and alleys. The alterations in fittings under the Board of Trade rules and regulations are being gradually effected as occasion offers, and are carried out in all new buildings.

EXPLOSIONS OF GAS.

The following letter upon the subject of gas explosions recently appeared in the *Standard* newspaper:—

"Sir,—An explosion of gas occurred a few days since in the private house of a gentleman holding a situation in the Bank of England, the details of which are instructive to all who come in contact with inflammable gases. The master of the house rose before the other inmates for the purposes of study, and went into a basement room, where he smelt an escape of gas. He observed that the sliding chandelier had sunk during the night. He thoughtlessly lit a taper to test the burners, but found no escape. He raised his hand above his head to test the other parts of the chandelier, when immediately a terrible explosion occurred. The air in the lower part of the room had not sufficient gas intermixed with it to render it explosive, although, according to Graham's law of diffusion, the air and gas throughout the entire apartment would in time have been thoroughly intermixed. In the lower part of the room the light burned with impunity. At a level above the head of the person the air and gas had mixed so as to be in explosive proportions, and it is probable at the ceiling almost pure gas existed alone. The effects of the explosion were severe for so small a quantity of gas. In the same room the door was wrenched off and the door-posts thrown out of place, the windows were blown out, the glass broken, and the woodwork was scorched. The kitchen door was blown in and the windows destroyed. The force passed upstairs and blew in the dining-room and drawing-room doors, although they were locked, and shattered thick plate-glass windows; it broke to pieces a third sheet of plate glass over the street door, and then passed upstairs to a bed-room, where windows and sashes were blown into the garden with such force that fragments of glass were thrown 56 feet from the house, and the force was finally expended by breaking windows in the rooms of the top floor. The furniture and house itself were also injured. The master escaped with a severe burn on both hands and of the skin of the face, the hair being also set alight.

"The cause of the accident arose from an absence of sufficient water in the sliding chandelier. An attempt was made to fill it the day before, but it was not properly done. When water is put into a chandelier the gas should be turned off from the house and the stop-cock of a burner turned on, otherwise the gas in the pipes of the chandelier prevents the proper entry of the water. Sliding chandeliers are also so delicately balanced that if heavier glasses be used than usual the whole chandelier, as in this case, drops, the gas escapes, and an explosion occurs.

"This accident teaches an important lesson, that where gas may escape it is desirable that there should be an aperture at the upper part of the room, so that gas may not collect as in a bell glass. The phenomena which have been here exhibited are familiar to every natural philosopher and chemist, yet they teach an important practical lesson, and to no one more than to the coal miner, for in his operations he leaves an excavation like a dome. Gas may collect, and air and gas will surely intermix in explosive proportions. A miner may walk below with an open candle with impunity, but if he raises his hand an explosion will arise which may hurry the whole of the miners in the colliery to destruction.

"Gas, if rightly used, is perhaps the safest of all artificial means of illumination, but, as in this case, if the teachings of natural laws be not obeyed, the danger of fire and explosions, and of injury to person and property, may arise.

"*Bank of England, Sept. 4.*" "ALFRED SMEE.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

It cannot be said that there is any further great improvement in the condition of the local iron trade as a whole, but it is a matter for congratulation, at least, that the previously reported amelioration is maintained.

Pig iron is pretty steady at a shilling or two less money than was required a week back. Agents for Middlesborough firms now quote as under for net cash:—No. 1 foundry, 73s. 6d.; No. 2, 71s.; No. 3, 69s. 6d.; No. 4, 62s. 6d.; No. 4 forge, grey, 58s. 6d.; No. 5 forge, mottled, 59s.; No. 6 forge, white, 55s. 6d. Refined metal, 80s.; Kentledge, 70s.; and cinder, 50s. Other brands of foundry pig iron firm, Scotch iron being several shillings per ton dearer this week.

At the leading foundries a good deal of work is being done, a fair proportion of the total production being large-sized pipes for water mains and gas-mains. The Staveley Company is still busy in this capacity for the Sheffield companies, and for undertakings at a somewhat greater distance.

The brass-works are doing a healthy and very brisk business in all kinds of plumbers brass-work, engine brasses, water-works patent articles, and hydrant, &c., castings.

The merchant iron trade here is somewhat brisker, despite which prices have just been considerably reduced—a matter of some interest to your readers. The Bowling Company, whose productions are well known throughout the whole kingdom, have lowered prices by 40s. per ton, and other firms have reduced bar iron 10s., and hoops 20s. per ton, making ordinary merchant bars £11 per ton, and hoops £14. Good orders could, however, be "done" at considerably lower figures—say to the extent of 10s. per ton. Fuel is, in the main, pretty firm, but engine coal is difficult to dispose of even at very low prices. At some of the pits not more than 4s. to 5s. per ton is being asked.

IRON AND COAL TRADES OF SOUTH STAFFORDSHIRE AND EAST WORCESTERSHIRE.

(FROM OUR OWN CORRESPONDENT.)

There is little change in the condition of the finished iron trade since last report. The mills and forges are, as a rule, in active operation, though only the more urgent orders are being placed at current rates. A reduction of prices at quarter-day now seems inevitable, and the only real difference of opinion existing is whether the reduction will be £1 or £2 per ton. The accountant is now engaged in ascertaining the average selling prices of iron throughout the district, in order that the wages question may be settled according to the provisions of the agreement entered into in April last, and it is anticipated that a reduction in ironworkers wages will be declared; and this, coupled with the easier rates of fuel, would seem to justify a reduction of £2 per ton on merchant iron—a course which we are assured would give a healthy tone to the trade. Sheets for galvanizing purposes are still in especially active request, though as the quarter advances there is a decidedly weaker tendency in prices. Some of the leading makers are now willing to accept orders for forward delivery at from £12 to £12 10s. per ton, but few are prepared to negotiate at all for the supply of immediate requirements.

A meeting of the ironworkers of the Wolverhampton district was held a few days ago, when the men were advised by the union agents to offer no resistance to the introduction of mechanical processes of iron-making, and the following resolution was also passed:—"That this meeting considers the time has arrived when the ironworkers should purchase and erect iron-works, to be conducted by ironworkers under the principles of co-operation, and pledges itself to further the movement." This meeting was the subject of general discussion "on 'Change," and the masters, with the more intelligent of the men, agree that there is now urgent need for the adoption of labour-saving machinery in the puddling department of the trade.

The pig iron trade is slowly improving, and prices are still maintained, consequently only small lots are at present changing hands. Common cinder pigs are offered at £3 5s., and hot air all mine at £5 10s. to £6.

Foundry pigs are in more active demand than forge qualities, and command a ready sale at late quotations. On the Dudley side of the district more furnaces are being relighted, and there is every prospect of a better trade so soon as the benefit of the full reduction in fuel is felt.

The coal trade, though gradually improving, is still inactive, and prices are very irregular, owing to the underselling now prevalent, at the reduced rates. Earl Dudley's forge coal will be 13s. per ton, but commoner qualities may in

some cases be had as low as 9s. The collieries are only in partial operation, and the present limited output is disposed of with difficulty. The Cannock Chase firms have not yet made any reduction in prices; but it is expected that they will submit to a fall of at least 2s. per ton on best coals next quarter. Coke is in much improved request, and some of the small colliery owners are erecting ovens for the conversion of their fuel into coke; and it is stated that in the present condition of the trade they are able in this way to dispose of their produce to greater advantage.

THE COAL AND IRON TRADES OF LANCASHIRE.

(FROM OUR OWN CORRESPONDENT.)

The coal trade of this district, especially in the better qualities, continues to show considerable improvement, but common coal and common burgy are still difficult to move. Prices generally remain without any alteration in the Manchester market, and pit prices in the district are about the same as those last quoted, but sellers are stiffer in consequence of the strike threatened in the Wigan district. When, however, the dispute which, it is thought, will not be of long duration, is settled, and the reduced wages come into force, it is not improbable, so far at least as the Wigan district is concerned, with the present state of the market, that lower prices may rule, as the colliers, in order to bring their wages up to the old level, will work with more regularity, and thus throw more coal upon the market.

The gas coal trade continues steady, and although during the past week there have not been many inquiries for contracts in the market, prices are firm. Best hand-picked gas coal at the pit's mouth is quoted at 10s., and ordinary screened gas coal at from 12s. to 14s. per ton.

In the coke trade there is no alteration to notice, and prices are steady.

At a private meeting of the executive committee of the Amalgamated Association of Miners held in Manchester on Thursday and Friday, the wages dispute in West Lancashire was under consideration, and the opinion was expressed that, so far as the men were concerned, no settlement could be arrived at except by arbitration, and it was resolved that a letter should be written to the secretary of the Employers Association, requesting that before the notices expire on the 30th inst., a meeting with the masters should be held, in order a that, if possible, a strike might be averted by referring the matter to arbitration. To the deputations which have already waited on the masters, arbitration has, however, without exception, been refused, and it is more than doubtful whether the colliery proprietors will submit to such an arrangement now.

In the iron trade the demand has been a little easier during the past week, and although Scotch iron in the Manchester market has advanced some 3s. or 4s. per ton, prices generally have shown a weakening tendency, and Middlesborough makes have again receded about 6d. per ton. Foundry iron is now exceedingly plentiful, the great disparity between the price of this description and forge iron having induced the furnace proprietors to turn out as much of the better quality as possible, until it has now become almost a drug upon the market, while forge is becoming rather scarce, and the prices of the two qualities are now approaching more to their proper relative value. No. 1 Middlesborough pig iron, delivered in the Manchester district, is quoted at 78s. 9d.; No. 2, 76s. 9d.; No. 3, 74s. 6d.; No. 4, foundry, 72s. 6d.; and No. 4, forge, 67s. per ton. In manufactured, prices continue firm, but there has, perhaps, not been quite so much business doing during the past week. Ordinary bars are quoted at £9 15s. per ton, light rails at £9 10s., and heavy ditto at about £8 10s. per ton delivered.

The rolling mills continue busy, and are so fully engaged at present that iron for early delivery is rather difficult to obtain. There is, however, not so much activity at the blast-furnaces, and in South-West Lancashire the furnacemen and other *employés* have received notice of a 10 per cent. reduction in wages.

COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

Business in the coal trade of the North of England last week was a trifle dull. The rush of a fortnight ago, in getting shipments away when there was an alarm of a strike, is still affecting trade. The reaction has been pretty considerable, though it has not to any great extent affected prices. There is less inquiry for the second class of gas coals, and fewer shipments, except to the Channel and east coast, by small sailing vessels. Household coals are in moderate request, and fewer steam coals are being placed on board ship. There is a better demand for second-class steam coals than for the higher qualities, especially for foreign shipment. Inferior coals of all sorts continue to be a drug in the market, and some kinds of small coals have fallen as low as 4s. per ton. The arbitrators to whom the wages question in the Durham coal district has been referred will meet this week, and there is every prospect of a quiet settlement of the dispute. The Northumberland men are also likely to get affairs arranged in their district without any serious misunderstanding.

The supply of coasting tonnage in the coal ports last week was somewhat short, and a little more money had to be paid upon freights to the Channel and east coast. Outward business to the Continent was very dull. The freight market to the Mediterranean has not been so flat for many years as it is at present.

In the Cleveland iron district business has not been so brisk, and prices have been easier. For forge pig iron inquiries have been numerous. A considerable quantity of pig iron is reported to have been shipped to the northern ports of Europe. A good deal of manufactured iron is being sent by steamer from the Tyne to the Continent.

The general trade of the North of England, with some few exceptions, is firm and good. Fire-clay goods have not been quite in such demand; but the larger establishments, which have contracts running, will be kept busy until the end of the shipping season. The steamers are loading up with goods to most places, except Germany. The chemical trade was rather quiet last week; but it is much firmer in tone than it was a month ago.

The Associated Chambers of Commerce held their meetings in Newcastle last week. On Thursday the representatives took a survey of the Tyne, and had an opportunity of making themselves acquainted with the approved methods of manufacture in connexion with the chemical trade of that river.

HARROW DISTRICT GAS COMPANY.—The half-yearly meeting of shareholders was held last Thursday at the Guildhall Coffee House, London—Mr. J. Glaisher in the chair. The report stated that the business and progress of the company during the half year had been satisfactory. The plant and apparatus were in an efficient condition; the new tank and gasholder were being pressed forward, and would be finished in time for the requirements of the winter. The gross rental during the half year amounted to £1953 1s. 4d., being an increase on the corresponding period of last year of £217 18s. 4d. The chairman, in moving the adoption of the report, referred to the decrease in the value of coke, and the increase in the price of coal, which accounted for the net profits showing a diminution compared with last half year. Coal, however, had now decreased in price, and he fully anticipated a better state of things for the coming half-year. Mr. W. Low thought the report unsatisfactory, and put a number of questions relative to it, which were replied to by the chairman and secretary. The report and accounts were then adopted, and a dividend at the rate of 4 per cent. per annum, free of income-tax, was declared.

GALASHIELS WATER SUPPLY.—Two rival companies are proposing to supply Galashiels with water. One of them, says the weekly *Scotsman*, is, we believe, the same company that proposed to supply water to Edinburgh from Manor, and has Mr. Stewart for engineer. This company proposes to bring water to Galashiels from Luggate; but the exact terms have not as yet been made public. A proposal from another source has just been issued, of which Mr. Bell is the engineer, in which it is contemplated to bring water from Caddon, at the estimated cost of £15,240, exclusive of compensation for the abstraction of the water and for land. This is to supply 40 gallons per head per day to 20,000 inhabitants. The proposed clear-water basin is to hold 3,000,000 gallons, and the town cistern 300,000 gallons. The proposal is to draw the water from the stream at a point in the neighbourhood of Windydoors, and to convey it along the slopes of the Caddon and Meigle Hills to the distributing reservoirs situated above the Windyknowe Road on the 600 feet contour Ordnance survey. The quality of the water is stated to be unexceptionable, and to be derived from a gathering area of eight square miles of almost wholly uncultivated land. The length of pipe-track is 6½ miles.

TROWBRIDGE WATER-WORKS COMPANY.—A meeting of the shareholders was held at their office, in Cambridge, on the 16th inst.—Mr. S. Peed in the chair—to authorize the directors to exercise the borrowing powers of the company to the extent named in their engineer's estimate for the works. The following gratifying report of the engineer (Mr. H. Tomlison) was read to the shareholders:—"I am very pleased to inform you that the company's works are in full operation, and the supply from Upton is laid on to the town under pressure. I have just tested the effective pressure at a gauge attached to a hydrant near the town bridge. It is only fair to remark that this is a low part of the town, but the effective pressure was 83 lbs. on the square inch, the equivalent height in feet being about 190. I may mention that on Saturday last, I made a similar test in Freeschool Lane, Cambridge, at the hydrant, opposite the Cavendish Schools. In this case the effective pressure was 47½ lbs. (or about 109 feet). These figures will enable you to make a comparison. The new services are coming in very fairly, and amongst them are several orders for services where a large quantity of water will be required. I am in treaty with one of the largest manufacturers in the town for a supply of water at his cloth factory. I may state generally that I consider the works to be in a satisfactory state.

ARBROATH ASSESSMENTS.—A local paper says: "The ratepayers in Arbroath are to be afflicted with a rise in their police assessment, consequent on financial recklessness during the last two years in 'over-running the constable.' But an increase of 1½d. for police purposes is not so serious as the new gas guarantee rate of 6½ per pound. This no doubt is owing to the high price of coal, but the ratepayers in Arbroath are suffering from their local authorities, when they resolved to take over the gas-works, not following the example of Dundee in laying it down as a principle that whatever profit or loss is made on the manufacture of gas shall be allocated to the gas consumers—the profit of one year going to reduce the price, or the loss being made up by an increase of the price in the following year. In Arbroath, if we mistake not, the commissioners can appropriate the profit, when there is one, to reduce the police assessment; but it is very awkward when they have suddenly to put on a guarantee rate of 6½d. per pound, which in some cases will fall heavily on parties who burn comparatively little gas. The Dundee system is in every way the most equitable, and we would recommend its adoption wherever gas-works are taken over by local corporations."

LIVERPOOL WASTE WATER METER SYSTEM.—At the meeting of the Liverpool Water Committee on the 21st inst., Mr. Deacon, the engineer, made the following report as to the conditions of water supply during the first 35 weeks of this year, as compared with the first 35 weeks of last year:—During the first 35 weeks of 1873, the average duration of supply per day in the borough was—to 482,868 persons, 9¾ hours; to 21,000 persons, 24 hours. In the out-townships for 26 weeks, 24 hours to all; for nine weeks to 75,000 persons, 12 hours; to 33,000 persons, 24 hours. During the first 35 weeks of 1874, the average duration of supply per day in the borough was—to 447,214 persons, 10½ hours; to 62,000 persons, 24 hours. In the out-townships, all 24 hours. During the first 35 weeks of 1873 the water sold by meter for trade purposes was about 544 millions; and during the first 35 weeks of 1874 it was 612 millions. From this comparison it is evident that the distribution of water has recently approached much more nearly to a constant service over the whole district of supply than last year, and it may be added than at any other period since the year 1864; and this notwithstanding the fact that the trade supplies, for which payment is received at the rate of 9d. and 11d. per 1000 gallons, have largely increased. Under these circumstances it would be generally supposed that much more water must have been taken for domestic purposes than last year, but it appears that, after allowing for the increase of population, and deducting the trade supplies by meter in each case, the supply during the first 35 weeks of last year was 3741 million gallons, and during the first 35 weeks of this year 3677 million gallons, leaving a saving of 64 million gallons in the domestic supply. It is evident, therefore, that, by the help of the district waste water meter system, a constant domestic supply is being rapidly introduced instead of the former intermittent supply, and that with a considerable saving in the quantity of water taken. The water thus saved, being applied to meet the increase of supplies by meter, will realize, at 9d. per 1000 gallons, about £2400 per annum. At the present date about 110,000 persons in the borough and the out-townships, containing 114,000 persons are receiving constant supply, and a much larger saving is being effected than the above comparison shows.

A NOVELTY IN GAS-MAKING.—Some time ago we noticed a new method of heating applied to the conservatories and greenhouses at Niddry House, whereby a great saving of coal was effected. Within the beautiful grounds which surround Mr. Wauchope's mansion a small limekiln was erected, in the flues of which two of the ordinary puddle boilers were fitted up. Attached to these are some 2000 feet of piping, extending to the most distant of the greenhouses, and the fact that an equable heat has been maintained by this system is abundantly proved by the thriving state of vegetation in the houses. The heat of the kiln being, however, more than sufficient for the boilers of this apparatus, it occurred to Mr. Gordon, the gardener of the estate, that the surplus might be turned to account in making gas; and accordingly in February last an ordinary retort, 5½ feet long by 12 inches in the bore, was built horizontally into the kiln, just above the cast-iron door by which it is fed. The mouthpiece of the retort projects about a foot from the front wall, and from its upper side there rises a pipe by which gas evolved within it is conveyed to an hydraulic main over the top of the furnace. Through this main the gas passes to the condensers, then to the purifiers, and finally to a gasholder, about 100 yards from the furnace, from which pipes are laid to supply the house. The experiment has proved eminently successful, and it is found that of the heat generated by the burning of the lime there is yet a good deal to spare. By one charge of the retort with common gas coal about 100 cubic feet of gas are distilled, and it may be noted that the kiln which supplies heat to the boilers and retort is one with a draw of half a ton per day. The limestone is used in the proportion of two-thirds to one-third of coal, and it is expected that by selling the burnt lime the expenses connected with the making of gas, as well as the heating of the conservatories, will be nearly covered. Were the system carried out to any extent—provided always that limestone could be obtained at a small cost—there would actually be a profit on the operations. Mr. Wauchope proposes, we understand, to take out a patent for the principle, which can hardly fail to commend itself to country gentlemen and horticulturists.—*Scotsman.*

EDINBURGH WATER SUPPLY.—It has been resolved by the District Water Trustees that the construction of the reservoir on the South Esk, at Gladhouse Mill, should be proceeded with immediately, and the clerk was accordingly instructed to advertise for estimates. This reservoir, it may be remembered, is one of the main features of the Moorfoot scheme—the idea being to dam up the waters of the South Esk by means of an embankment nearly 1000 feet long,

and in the centre 70 feet high; by which means a lake will be formed which will have an extreme length of over 6000 feet, a breadth of 5000 feet, and a storeage capacity of 236 million cubic feet. In all, the superficial area of the Gladhouse reservoir will be about 363 acres. Besides augmenting the present supply of the city, there will also be discharged from this reservoir daily over 2¼ million gallons of water, by way of compensation to the South Esk. At the meeting of the Trust, on the 24th inst., the Lord Provost said that, in order to remove false impressions which had been created by statements as to the operations of the new Act, he had had an estimate prepared, which he would lay before the meeting. It was as follows:—The total quantity of water to be got from the district under the Act of 1874, when the works are fully completed, including the supply from Portmore and Tweeddale Burn, will be 7,339,917 gallons per day. The daily estimated yield of the Gladhouse reservoir is 7,663,750 gallons, from which there falls to be deducted—1, Compensation to the river, 2,264,583 gallons; 2, Newbattle Mill, 135,000; 3, estate of Arniston, 135,000; 4, estate of Kirkhill, 3000; 5, estate of Dalhousie, 20,000; 6, estate of Newbattle, 100,000; 7, estate of Dalkeith, 100,000; total, 2,757,583, leaving for town supply a quantity of 4,906,167 gallons per day. The water will be introduced in 1877, and, estimating the population in that year to be 281,220, the above 4,906,167 gallons will add 17·44 gallons per head to the present supply. The supply will then be 45 gallons per head to the above population. When Portmore and Tweedale Burn waters are introduced, the supply will be, from Gladhouse 4,906,167 gallons; from Portmore, 762,500 gallons; and from Tweeddale Burn, 1,671,250 gallons; total, 7,339,917 gallons. The total supply from all sources will then be 15 million gallons per day, equal to 48·30 gallons per head per day to a population of 310,493, which it is estimated it will be in 1881, the period allowed in the Act to finish the works. The district of Musselburgh requires to be supplied as ordinary consumers in the city, and at such price per 1000 gallons as may be agreed upon; they may need 350,000 gallons per day. Beyond the 100,000 gallons for the Duke of Buccleuch's estate under the Act, the Trust is not under further obligations to Dalkeith; but, inasmuch as they may have water to spare to that district as ordinary consumers, there is no reason why it may or may not be given to them on payment, rather than allow it to run to the sea, and so to be lost altogether. They say that they may need at Dalkeith 150,000 gallons, which quantity, added to Musselburgh, would make 500,000 gallons; but even supposing 1 million gallons might thus be disposed of, yielding a profit to the trust, the supply remaining to the city would still give 45 gallons per head per day to a population of 310,493. In addition to the statement just made, there is no mention of Rosebery, the gathering-ground of which will yield 1,349,685 gallons, open at any time to the trustees by agreement with Musselburgh. If this be found needful in the course of years, by an unopposed parliamentary measure, the total supply would then be brought up practically to that stated in the *plébiscite*—namely, 8,689,602 gallons per day, as against 8,896,000, the difference being accounted for by increased compensation to landowners being granted.

Register of New Patents.

301.—HACHE, E. H., Paris, "*An improved mechanical apparatus for indicating by clockwork the excessive pressures of lighting gas.*" Provisional protection only obtained. Dated Jan. 23, 1874.

This apparatus consists of three principal parts—a manometer, a clock movement, with a bell put in communication by a balanced lever or float, the whole being enclosed in a case whence only the bell is excluded.

The manometer comprises a receiver of glass, which is held within the apparatus by a partition, and provided on the exterior with a graduated band. In its cover is fixed, at the middle of the receiver, a long glass tube, which descends nearly to the bottom. To the lower end is fixed a metallic case, carrying a tube which debouches at the top, in order to receive the flask or bottle intended to maintain the constant level corresponding to zero in the graduated scale upon the receiver. The flask consists of a glass gauge, provided with two cases; the lower one serves as a bottom, and is in a piece with the tube, while the other is provided with a loop-piece with two grooved holes, constituting a sort of bayonet closing, very easy to open and shut. The tube descends nearly to the bottom of the other tube, and contains a small rod or trough, which carries at its top the closing-valve, which, abutting against the closing-cock and against the bottom of the branch of the tube, maintains the valve open. By this arrangement the constant level of the liquid is assured.

The float is formed of a long metallic hollow cylinder, which is provided exteriorly with little fingers, intended to prevent it from rubbing against the partition of the tube, which would diminish its sensibility. This float is provided at its top with a handle, and by its aid it is attached to the rock lever, which is supported at the place of its articulation upon a cap forming a body. At its hinder part the lever is curved upwards, and is closed in a case of flexible material. The lever carries a counterweight, by which the action of the bell is regulated with precision.

From the preceding description it will be seen that as soon as the pressure of gas rises above what is usual and necessary, the level of the coloured water rises in the manometer tube, and draws the float in its ascending movement. When the float mounts the lever moves upon its axis, and descending permits the escape of the disc. Immediately the mechanism causes the sounding of the bell, and warning is given.

317.—LUCAS, E. F. R., Coatham, Redcar, "*Improvements in the manufacture of anthracene.*" Patent dated Jan. 24, 1874.

Under this invention, anthracene is obtained from the heavy coal tar oils which distil at from 260° to 360° Celsius, by passing the same or the vapours thereof through pipes or retorts previously raised to a red heat. The heated surface is increased by filling the pipes or retorts with pieces of firebrick. The oil obtained by this operation is submitted to distillation, and the distillate which passes over after 360° Celsius, is collected separately, cooled, and pressed, the press cake thereby obtained being crude anthracene. The liquid oil resulting from this distillation is again passed through red-hot pipes or retorts, and another portion of anthracence is obtained therefrom.

322.—CLARK, A. M., Chancery Lane, London, "*An improved process for eliminating the soluble principles contained in gases and vapours.*" A communication. Patent dated Jan. 24, 1874.

A description of this invention with illustrative drawing appears in the present number of the JOURNAL.

342.—LAKE, W. R., Southampton Buildings, London, "*An improved apparatus for maintaining a constant level of water in wet gas-meters, and for separating from vapour liquid held in suspension in the same.*" A communication. Patent dated Jan. 27, 1874.

This invention relates to maintaining a constant level of water in wet gas-meters by separating from vapour liquid held in suspension in the same when the gas leaves the gas-meter, and consists in forming the pipe next to the outlet with two perforated concentric inner cylinders, through which the gas flows. The water held in suspension in the gas is retained on the walls of these cylinders, and falls down them into the meter again. Instead of being perforated, the cylinders may be formed like Venetian blinds, with blades fixed at proper distances from one another, upon which the water is arrested in order to fall down in the meter, as above stated.

348.—WHITTINGHAM, J., Great St. Helen's, "*Improved apparatus for manufacturing gas for illumination.*" A communication. Patent dated Jan. 27, 1874.

This invention relates—1. To improved apparatus to be used in the distillation of coal, the chief object being to increase the per centage yield of gas. 2. To a novel construction of scrubber, in which the gas is readily cooled and cleansed of some of its impurities. 3. To a novel construction of purifier, which admits of the purifying material, when saturated, being quickly removed and replaced by fresh material.

The retorts employed will be cylindrical, and constructed and fitted in any approved manner. Instead of charging the retorts as usual, the coal to be distilled is placed in cylindrical iron cradles contained in the retort, and extending from end to end thereof, or nearly so.

The cradle is formed of strips of wrought iron, arranged somewhat after the manner of the staves of a barrel or drum (but with open joints), and held together by means of rings of wrought iron, the ends of the strips being reduced in thickness to form shoulders for the rings to butt against. The cradle is of such diameter that it will fit loosely within its retort, and when charged its ends are closed by a cover. On the rim of the front end of the cradle is formed a segment-shaped opening by the application thereto of a piece of hoop-iron, to allow of the gas which distils off from the charge and flows out between the joints of the staves, finding its way to the head of the retort and escaping therefrom as usual. The cradles when placed in the retorts are secured in position by wedges or bolts passed through the mouthpieces, one at each side thereof. By the use of cradles, such as that described, the coal will be found to yield more gas than is now obtained, and also about 1½ cwt. more of coke per ton of coal.

Another advantage incidental to the use of these cradles is, that after being used for a certain time, say about 18 days, more or less, the iron composing the cradles will be found to be converted into steel. Thus not only will their cost be covered by the increased value given to the iron, but the converting power of the coal (which is now wasted) will be utilized.

The scrubber and condenser which constitutes the second head of the invention, consists of an air-tight chamber of cast or wrought iron, through which a series of vertical air channels is formed transversely of the condenser, their length being somewhat short of the width of the condenser. The object of this arrangement of air channels is to divide up the external space, and to allow cool atmospheric air to act upon the heated gas admitted to the condenser. The spaces into which the condenser or scrubber is divided by means of these transverse air passages are severally divided up by means of two vertical partitions. The gas to be washed and cooled enters through a pipe at one end of the condenser, and by reason of the succession of partitions contained in the several divisions of the condenser, the gas is compelled to follow a serpentine or zig-zag course in reaching the exit-pipe at the opposite end of the condenser. It is also caused to travel round the air passages, which being formed of metal will ensure a rapid extraction of the heat from the gas.

Fitted within the several divisions of the condenser is a box or receptacle with a porous bottom. These boxes are charged through man-holes in the sides of the condenser with coke which forms an intercepting filtering medium for the gas. Immediately above the coke receptacles are pipes for discharging ammoniacal water thereon, and below one or more of these receptacles at the bottom of the condenser, is a syphon for drawing-off into a closed channel the ammoniacal water as it falls in a shower through the ascending gas. Other liquids may, if desired, be thrown into the condenser, or the gas may be caused to mingle with other gases discharged by jets into the condenser.

The purifier which constitutes the third head of the invention, consists of a chamber of cast or wrought iron which is divided by transverse partitions, such partitions affording alternately a passage for the gas above and below them. On the top of the chamber is a trough-like extension, and each division of the chamber is extended upwards by a lip or flange into the trough. These extensions are intended to receive a cover, which is closed by a water joint, and they are held down in place (gunny-bags or other suitable packing being interposed between them and the mouths of the chamber) by means of clamping screws fitted to cross-bars, the ends of which enter fixed lugs, on the sides of the trough, such clamping screws bearing upon blocks of wood interposed between them and the covers. In each division of the chambers vertical guides are provided to receive vessels containing the lime or other purifying material.

These vessels are by preference made in the following manner:—A shallow metal tray of a width sufficient to reach across from one pair of guides to the other, and equal in length to the depth of the chamber, is divided up by transverse plates into, say, four compartments. Upon this tray is fitted a metal cover which is readily detachable therefrom to allow of access thereto. The trays and their covers are formed of pierced plates, and the trays are made about 4 inches deep. When the tray is filled with lime or other suitable absorbent, the lid is secured in place by pins passing through lugs which are riveted to the tray, and project through slots made for them in the perforated cover. The porous vessels when charged with lime or other purifying material are dropped into their places between the guides. When all the divisions of the purifier are thus charged the gas is admitted at one end, and on its way through the purifier to the discharge pipe will be caused to percolate through the purifying material, and yield up its sulphur and other impurities as in the ordinary dry lime purifier.

The chief advantage of this novel construction of purifier, is that it admits of rapid renewal trays of the purifying material being kept ready charged to take the place of the trays containing the exhausted material.

353.—CHARLES, P., Stoke Newington, "*Improvements in apparatus for controlling the supply of water to closets, lavatories, and other places; and preventing waste.*" Patent dated Jan. 28, 1874.

This apparatus consists of a measuring cistern provided with an outlet-pipe rising to a certain height, on which a hollow box or displacer is fitted to rise and fall, whereby the water is made to overflow into the outlet-pipe when desired, a portion being also retained as after supply to seal the basin, in the case of a closet.

384.—EDWARDS, J., South Hackney, "*Improvements in the manufacture of valves.*" Provisional protection only obtained. Dated Jan. 30, 1874.

These improvements consist in making valves of two metal shells and an inner disc, the front shell being made to fit into the bottom one. In the bottom shell is formed a nipple for fixing the valve. The front shell is pierced with a round hole to admit part of the inner disc, which is formed with a flange on which rests a flexible washer. A spring is inserted between the disc and the bottom shell to force the disc against the front shell.

403.—LUMLEY, T., Harborne, Staffs, "*Improvements in steam-pumps.*" Patent dated Jan. 31, 1874.

This invention consists in working the cylinders of steam-pumps by arranging at each end a chamber in a small cylinder, in which a valve works for putting the cylinder in communication either with the exhaust or with the steam. An opening is made near each end of the steam cylinder, the opening at one end being in communication with the valve cylinder at the other end with the steam cylinder. As the piston approaches the end of its stroke, steam is allowed to pass through the opening in the steam cylinder to the valve cylinder at the other end of the steam cylinder, and the valve therein connects the steam cylinder with the exhaust; at the same time the steam-cylinder piston strikes the valve at the same end of the cylinder and opens the steam way. The piston in completing its stroke in either direction is thus made so to act upon the valves as to change that which was the exhaust side of the piston into the steam side, and the reverse.

404.—CHERRY, H., Handsworth, Staffs, "*Improvements in steam-pumps.*" Patent dated Jan. 31, 1874.

According to this invention, a loaded valve is placed in the suction-pipe for the

purpose of producing a vacuum into which the exhaust steam is discharged. At the upper part of the condenser is a chamber which first receives the water raised, and from which it passes through the loaded valve by which it is spread into a thin sheet, and then falls into the condenser. A bell-mouth pipe is situated in the axis of the condenser, the lower end leading to the pump. By this arrangement a quantity of water always remains in the condenser, which effects the condensation of the steam when the pump is first started. Various arrangements are described for pressing the loaded valve to its seat.

APPLICATIONS FOR LETTERS PATENT.

3190.—MARCHANT, R. M., Kirby Street, Hatton Garden, London, "Improvements in or connected with steam and other motive-power engines, part of the invention being applicable to the manufacture of gas." Sept. 18, 1874.

3193.—HOLDEN, J., Halifax, Yorks, "Improvements in apparatus for lifting, forcing, or pressing by water, air, or other liquid or fluid." Sept. 18, 1874.

3199.—KIDD, J. H., Wrexham, Denbigh, "Improvements in the mode of and in arrangements for manufacturing manure from sewage, nightsoil, and like matters, and in the preparation and application of certain materials for deodorizing sewage, nightsoil, and like matters." Sept. 19, 1874.

3200.—PUNSHON, R., Heatherleigh, Anerley Park, Surrey, "Improvements in fuel, applicable to heating and lighting purposes." Sept. 19, 1874.

3205.—CROSSLEY, F. W., Manchester, "Improvements in gas motor engines." Sept. 19, 874.

3225.—M'INTYRE, J., Port Glasgow, Renfrew, N.B., "Improvements in apparatus for purifying sewage waters." Sept. 21, 1874.

3232.—FORBES, Rev. G. H., Broughton, Northampton, "Improvements in compounds designed for fuel or the production of quicklime." Sept. 21, 1874.

3240.—MALAM, W., Forest Hill, Kent, and GRAVES, T., Lavender Hill, Surrey, "Improvements in apparatus for mixing air with the vapour of liquid hydrocarbons to be used for lighting and heating, or for any other purpose; also in the treatment of such hydrocarbons with a view to purifying the same and obtaining a useful product therefrom." Sept. 22, 1874.

3243.—PEACOCK, J. C., Finsbury Park Road, and BRADLEY, C. W., Circus Place, London, "Improvements in the manufacture of illuminating and heating gas and distributing thereof for use by means of apparatus adapted for said purposes. Sept. 22, 1874.

3252.—CHANDLER, Y., York Street, London Road, Southwark, and STEVENSON, G. W., Great George Street, Westminster, "Improvements in apparatus used in the manufacture of gas." (Complete specification.) Sept. 23, 1874.

3257.—LASCELLES, C. T. E., Brockley Road, Kent, "Improvements in the utilization of gas-engines as motors for tramway cars and similar vehicles." Sept. 23, 1874.

3269.—SPICE, R. P., Parliament Street, Westminster, "Improvements in apparatus used in the manufacture of gas." Sept. 24, 1874.

3279.—JONES, H. L., Ely Place, Holborn, London, "A combined flushing and deodorizing and disinfecting apparatus for use in urinals, water-closets, and similar purposes." Sept. 24, 1874.

GRANTS OF PROVISIONAL PROTECTION.

2952.—LOTZ, W. F., Carter Lane, London, "Improvements in the method and means of suspending chandeliers for gas or other lights, and adjusting them to the required height." A communication. Aug. 29, 1874.

2968.—SILBER, A. M., Whitecross Street, London, "Improved apparatus for lighting and heating purposes." Aug. 31, 1874.

3058.—LAKE, W. R., Southampton Buildings, London, "Improvements in portable hydrogen and carburetted hydrogen gas apparatus." A communication. Sept. 5, 1874.

3070.—WHITWORTH, J., Royton, Lancs, "Improvements in the construction of lamps for lighting gas." Sept. 7, 1874.

3082.—COOPER, W., Southampton, Hants, "An improved rotary steam-engine and pump." Sept. 8, 1874.

3108.—BRAY, H., Manchester, "Improvements in the manufacture of gas for illuminating and heating purposes." Sept. 10, 1874.

3152.—POCOCK, A. W., Church Street, Westminster, "Improvements in compensating wet gas-meters." Sept. 15, 1874.

NOTICES TO PROCEED.

1732.—UNDERHAY, F. G., Crawford Passage, Clerkenwell, London, "Improvements in apparatus for drawing off water to prevent or reduce waste." May 15, 1874.

1916.—JOHNSON, J. H., Lincoln's Inn Fields, London, "Improvements in apparatus for filtering or separating liquids from solid matters contained therein." A communication. June 2, 1874.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

1055.—NIELD, T. A., Dukinfield, Cheshire, "Improvements in taps or valves, adapted for use in controlling the flow or discharge of steam and other hot fluids." March 26, 1874.

1061.—BROWN, M. H., New Cross, Kent, and WHITE, M. G., Landport, Hants, "An improved disinfecting and deodorizing apparatus for water-closets and other purposes." March 26, 1874.

1072.—JENSEN, P., Chancery Lane, London, "Improvements in modes of and means for producing and utilizing gas and heat and apparatus therefor." A communication. March 27, 1874.

1157.—BIRCH, R. W. P., Victoria Street, Westminster, "Improvements in apparatus for flushing sewers, drains, reservoirs, and other waterways, applicable also for discharging measured quantities of water or other fluid." April 2, 1874.

1169.—VOISIN, J. A., and DRONIER, P., Paris, "An improved method of and apparatus for producing a light." April 4, 1874.

1269.—AUERBACH, G., and GESSERT, T., Elberfeld, Germany, "Improvements in manufacturing alizarin and isopurpurin out of anthracene." April 13, 1874.

1824.—BELL, J., Wishaw, N.B., "Improvements in distilling coal shale for the production of oil and gas, and in the apparatus employed therein." May 23, 1874.

2567.—WILLETT, G., HARRIS, R. J., and LUND, J., Worthing, Sussex, "Improvements in filtering sewage, and in the means for effecting the same." July 22, 1874.

2692.—RIGBY, J., and RIGBY, J., Manchester, "Improved apparatus for lighting and ventilating." Aug. 4, 1874.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

2462.—PAWSON, W., "Improvements in taps or valves for hot and cold water apparatus." Sept. 19, 1871.

2469.—PINN, C., "An improved apparatus for preventing waste of water in dwelling-houses and other buildings where water is supplied by pipes." Sept. 19, 1871.

PATENT WHICH HAS BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

2564.—RAE, J., "Improvements in portable apparatus for cleansing and filtering water for army and other purposes." Sept. 10, 1867.

Share List,

OF

Metropolitan Gas and Water Companies.

(*Corrected by Mr.* F. N. GOLDING, *Sun Court, Cornhill, from the latest Stock Exchange Quotations.*)

Number of Shares issued.	Amount per Share.	Name.	Amount paid up p. Share.	Dividend p. Cent. p. Annum.	Latest Quotations.
	£	GAS COMPANIES.	£ s. d.	£ s. d.	£
8000	20	Anglo-Romano	20 0 0	10 0 0	14 — 16
5000	20	Bahia (Limited)	20 0 0	3 0 0	10 — 11
1008	20	Do., preference	20 0 0	10 0 0	25 — 27
1000	20	Do., do., redeemable	20 0 0	10 0 0	20 — 22
1500	20	Do., perpetual preference	20 0 0	7 10 0	20 — 22
40000	5	Bombay (Limited)	5 0 0	6 15 0	6¼ — 7
10000	5	Do., fourth issue	4 0 0	6 15 0	1—1½ pm.
10000	20	British (Limited) (Norwich, Hull-Sculcoates, Hanley, Tunstall & Shelton [Potteries], Trowbridge., and Holywell.)	20 0 0	10 0 0	34 — 35
7500	20	Cagliari (Limited)	20 0 0	7 0 0	14 — 16
180000	10	*Chartered* A ordinary	10 0 0	10 0 0	16½— 17½
25000	10	Do. A, 5 per cent. preference	10 0 0	5 0 0	15 — 16
20000	10	Do. A, 5 per cent. do., 2nd issue	10 0 0	5 0 0	15 — 16
30000	10	Do. A, 5 per cent. do., 3rd issue	10 0 0	5 0 0	4¼—4½ pm.
10000	10	Do. B, 4 per cent. maximum	10 0 0	4 0 0	7 — 7½
20000	10	Do. C, 10 per cent. preference	10 0 0	10 0 0	20½— 21½
12000	25	Do. D, 10 per cent. preference	25 0 0	10 0 0	51 — 53
443875*l.*	Sk.	*Commercial*	100 0 0	10 0 0	171 —174
20000	20	Continental Union	20 0 0	8 0 0	19½— 20½
20000	20	Do., new	12 10 0	8 0 0	1 dis.—par
10000	20	Do., preference (Grmny.: Strsbg. France: Cette, Nismes, Montargis Vienne, Roanne, Beaucaire, Rueil, Albi. Italy: Milan, Genoa, Parma, Modena, Alessandria, Messina.)	20 0 0	7 0 0	24 — 26
5000	10	*Crystal Palace District*	10 0 0	10 0 0	16½— 17
5000	10	Do., preference	10 0 0	6 0 0	11½— 12½
10000	10	Do., ordinary	10 0 0	7 0 0	12½— 13½
2500	10	Do., converted	2 0 0	10 0 0	1½— 2 pm.
2500	10	Do., converted	2 0 0	7 0 0	1 —1½ pm.
23496	10	European (Limited)	10 0 0	10 0 0	14 — 15
12000	10	Do., new shares	7 10 0	10 0 0	2½—3 pm.
	10	Do., new shares (Boulogne, Amiens, Rouen, Caen, Havre, & Nantes.)	5 0 0	10 0 0	1½—2½ pm.
4054	10	Foreign and Colonial (Limited)	10 0 0	..	9 — 10
5000	10	Hong Kong (Limited)	10 0 0	10 0 0	14 — 15
1560000	100	*Imperial*	100 0 0	10 0 0	170 —173
78000	12½	Do., new shares	12 10 0	7 0 0	16 — 16½
1300	100	Do., bonds	£100	10 0 0	197 —200
56000	50	*Imperial Continental* (Amsterdam, Berlin, Ghent, Hanover, Lille, Rotterdam, Aix-la-Chapelle, Antwerp, Bordeaux, Brussels, Frankfort-on-Maine, Haarlem, Stolberg, and Vienna.)	43 15 0	9 2 6	59 — 61
3000	40	*Independent*	40 0 0	10 0 0	66 — 68
3000	10	Do.	10 0 0	5 0 0	8½ — 9½
3000	20	Do.	20 0 0	7 10 0	26 — 27
4500	10	Do., D	3 0 0	10 0 0	3 — 4 pm.
378350*l.*	Sk.	*London*	100 0 0	10 0 0	170 —172
150000*l.*	Sk.	Do., 1st preference	100 0 0	6 0 0	118 —121
14450	Sk.	Do., 2nd preference	100 0 0	6 0 0	
4350	Sk.	Do., 3rd preference	100 0 0	6 0 0	
7622	25	Do., A shares	12 10 0	6 0 0	
26805*l.*	All	Do., Debenture stock	100 0 0	5*l.* & 6*l.*	
15000	5	Malta and Mediterranean (Limited)	5 0 0	3 0 0	2 — 2½
6000	5	Do., preference	5 0 0	7 0 0	5 — 5½
20000	5	Mauritius (Limited)	2 0 0	7 0 0	2 — 2½
25000	20	Monte Video (Limited)	20 0 0	..	22½— 23½
8000	10	Nietheroy, Brazil (Limited)	10 0 0	..	
30000	5	Oriental (Calcutta)	5 0 0	9 0 0	7½— 7¾
30000	5	Do., new shares	2 10 0	9 0 0	1—1½ pm.
10000	5	Ottoman (Limited)	5 0 0	nil.	2 — 2½
17500	10	Pará (Limited)	10 0 0	7 0 0	6 — 8
27000	20	*Phœnix*	20 0 0	10 0 0	35 — 36
360000*l.*	100	Do., new	55 0 0	7 10 0	71 — 73
144000*l.*	Sk.	Do.	100 0 0	5 0 0	93 — 95
5000	20	*Ratcliff*	20 0 0	10 0 0	34 — 36
36000	20	Rio de Janeiro (Limited)	20 0 0	10 0 0	31 — 33
7359	5	Singapore (Limited)	5 0 0	7 10 0	4½— 5
2000	5	Do., preference	5 0 0	7 10 0	5½— 6
1500	32½	Shanghai	32 10 0	12 0 0	30 — 32
4000	50	*South Metropolitan*	50 0 0	10 0 0	86 — 88
4000	12½	Do.	12 10 0	10 0 0	21 — 21½
20000	12½	Do., new shares	5 0 0	10 0 0	6¼— 6¾ pm.
15000	10	*Surrey Consumers*	10 0 0	10 0 0	16½— 16¾
10000	10	Do., new	7 0 0	10 0 0	5 — 6 pm.
9000	4	United General (Limerick)	4 0 0	2 10 0	2 — 2½
1500	10	*Wandsworth and Putney*	10 0 0	10 0 0	14 — 15
1500	10	Do.	10 0 0	7 10 0	11 — 12
2957	10	Do.	10 0 0	7 0 0	
993	10	Do.	3 0 0	7 0 0	
16000	5	*West Ham*	5 0 0	10 0 0	7½— 8
10000	5	Do., new shares	2 10 0	10 0 0	3 — 4
		WATER COMPANIES.			
12000	100	Chelsea	100 0 0	6 0 0	134 —136
1800000	100	East London	100 0 0	6 0 0	125 —127
8000	50	Grand Junction	50 0 0	7 0 0	77 — 79
5840	25	Do., ¼ shares	25 0 0	7 0 0	36½— 37½
2160	25	Do., new do.; maximum dividend, 7½ per cent.	25 0 0	7 0 0	31 — 32
4396	100	Kent	100 0 0	6 10 0	128 —130
5339	100	Lambeth	100 0 0	6 5 0	127 —129
1161	100	Do.	20 0 0	6 5 0	
442	100	New River	100 0 0	8 0 0	170 —180
4475	100	Do.	30 0 0	8 0 0	50 — 55
400000	100	Do., debenture stock, 4 per cent.	100 0 0	4 0 0	97 — 99
3036	100	Southwark and Vauxhall	100 0 0	5 5 0	105 —107
1296	100	Do., preference stock	100 0 0	5 0 0	101 —103
	100	Do., D shares	100 0 0	5 5 0	104 —106
		Do.	..	4 10 0	
	100	Do., new ordinary	..	4 10 0	
1600	100	Do., new ordinary, No. 1	40 0 0	4 10 0	
12172	61	West Middlesex	61 0 0	£6 per sh.	135 —138

INFLAMMABLE GAS IN A WELL AT BELFAST.—Dr. Andrews, F.R.S., communicates to the *Chemical News* the following information:—"In sinking for a well upon the premises of Messrs. Cantrell and Cochrane, in George's Lane, Police Square, Belfast, after having passed through a deposit of silt to the depth of 33 feet, a layer of gravel was reached, 7 feet in thickness, and containing a quantity of organic *débris*. It rested upon a thick deposit of very tenacious clay. On entering the gravel-bed, a large flow of water occurred, which rose to within 4 feet of the surface of the ground, and interrupted the operation of boring, till a pump, worked by a small steam-engine, was erected, which, so long as it was in action, kept the boring free from water as far as the surface of the gravel-bed. A workman, having lowered a light to examine the bottom of the well, was surprised to see a lambent flame playing over the surface. On examination, this was found to arise from a disengagement of inflammable gas, which had accumulated between the lower surface of the bed of silt and the layer of gravel. An iron pipe terminating in a funnel-shaped mouth, about 1 foot in diameter, was sunk till it reached the gas stratum, and the water in the well was kept by pumping at such a level that an extra pressure of about 1 inch of water was maintained upon the gas below. The gas now flowed freely, at the rate of about 40 cubic inches per minute, through the upper end of the iron pipe, and, when ignited, burned with a yellow flame, which could scarcely be distinguished from that of ordinary coal gas. An analysis of the gas showed that its composition was—

Marsh gas (CH_4)	83·75
Carbonic acid	2·44
Oxygen	1·06
Nitrogen	12·75

The density of the gas (air = 1) was found to be 0·661, which corresponds nearly to the foregoing composition. The gas was inodorous and contained no compound of carbon and hydrogen except marsh gas. From this analysis it is evident that the gas formed in this subterranean sheet of water is in all respects the same as that which is produced in stagnant pools containing leaves and other vegetable matters."

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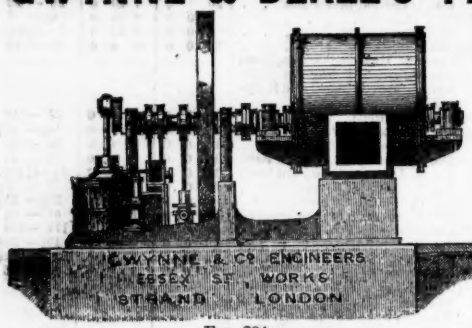

FIG. 224.

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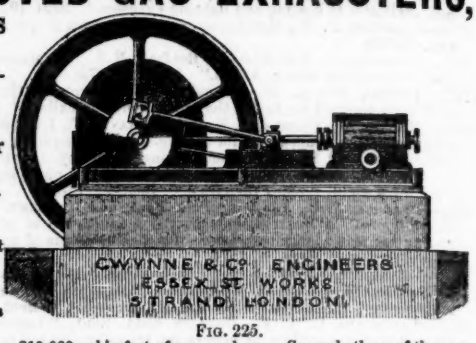

FIG. 225.

Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. Several others of the same size are now on order for the same Company. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the **most perfect system of action yet discovered.** Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 82,500 cubic feet per hour. GWYNNE AND CO. *do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality, and the most approved design and arrangement.* Their prices have been estimated with a due regard to the excellence of the article produced, and when this is taken into consideration, they have no fear for the result. The orders executed this season for Exhausters and alterations to their patented system amount to over 4,000,000 cubic feet of gas passed per hour, and to over 300 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction. Numerous testimonials and references can be given.

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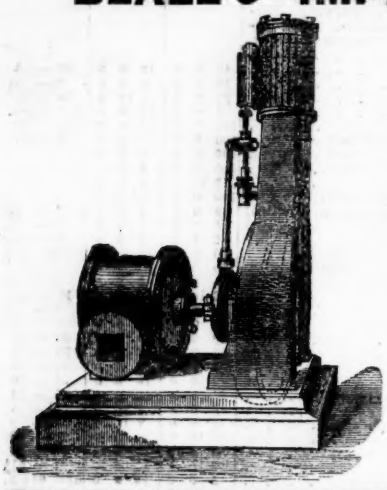

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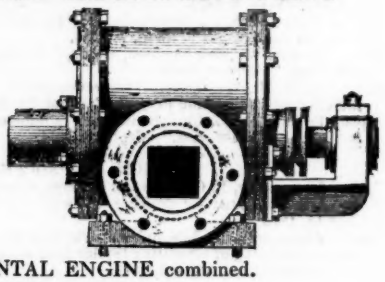

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THE Directors of the Stretford Gas Company invite TENDERS for the GAS TAR and AMMONIA WATER produced at their works for Two or Three years.
Tenders to be sent in on or before the 19th of October next. JAMES MOORE, Secretary.

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THE Corporation of Nottingham are desirous to receive TENDERS for the purchase of the TAR and AMMONIACAL LIQUOR to be manufactured at their stations at Nottingham, Radford, and Basford, in the next ensuing period of Five or Seven years, at the option of the Contractor, commencing on the 2nd day of November next.
The whole of the works of the Corporation are alongside public railways, and have branches into them, and the principal station (in the town of Nottingham) is located on the margin of the Nottingham Canal, which communicates with the general system of canals, and also with the navigable river Trent.
The annual quantity of Tar will probably amount to 650,000 gallons or upwards, and the annual quantity of Ammoniacal Liquor will probably amount to 1,500,000 gallons or upwards.
Intending Contractors will be supplied with forms of tender on application to Mr. J. Wilson, at the Gas Office, Nottingham, and the tenders must be delivered on or before Wednesday, the 7th day of October next.
SAM. GEO. JOHNSON, Town-Clerk.
Gas Department, Offices, George Street,
Nottingham, Sept. 16, 1874.

PHŒNIX GASLIGHT AND COKE COMPANY.

NOTICE is hereby given that the ADJOURNED HALF-YEARLY GENERAL MEETING of PROPRIETORS holding, previous to the 30th of June last, £300 paid-up capital and upwards in the said Company, will be held, pursuant to the Act of Incorporation, on WEDNESDAY, the 7th of October, at Two o'clock precisely, at the Bridge House Hotel, in the Borough of Southwark, for the purpose of declaring Dividends to the 30th of June last, and on other business.
The Transfer Books will be closed on and after the 23rd inst., and opened on the 8th of October.
By order of the Court of Directors,
ISAAC ADOLPHUS CROOKENDEN, Secretary.
70, Bankside, London, S.E., Sept. 15, 1874.

WELLINGBOROUGH GASLIGHT COMPANY, LIMITED.

THE Committee invite Tenders for the purchase of the surplus GAS COKE (about 8 to 10 tons per week), to March 31, 1875.
Tenders, offering price per ton at the works, or delivered at the L. & N. W. R. Station, Wellingborough, to be addressed to the Secretary.
The Committee do not bind themselves to accept the lowest or any tender.
S. H. KIMBELL, Secretary.

WIDNES GAS-WORKS EXTENSION.

THE Gas-Works Committee of the Widnes Local Board are prepared to receive TENDERS for the excavation, brickwork, &c., necessary in the construction of a GASHOLDER-TANK, 106 ft. 6 in. in diameter, and 26 ft. deep.
The Drawings and Specification may be seen daily, "Saturdays excepted," between the hours of Ten and Five, on application to the Engineer at the Gas-Works, of whom duplicate bills of quantities may be had on payment of one guinea.
Tenders to be addressed to the Chairman of the Gas-Works Committee, endorsed "Tender for Gasholder-Tank," and delivered at the Gas-Works, Widnes, not later than the 2nd of October next.
The Board do not bind themselves to accept the lowest or any tender. T. A. DREW,
Gas-Works, Widnes, Engineer and Manager.
Sept., 1874.

WREXHAM WATER-WORKS COMPANY.

CONTRACT FOR RESERVOIR.

THE Directors of the Wrexham Water- Works Company are prepared to receive TENDERS for the construction of an IMPOUNDING RESERVOIR, capable of containing about 40 million gallons, and situated in the township of Moreton Above, in the parish of Ruabon.
Plans and specifications, together with a schedule of quantities, can be seen on and after the 1st of October, at the Company's Offices, 5, Charles Street, Wrexham.
Copies of the specification, and schedule of quantities, can be obtained at the above address, at a charge of two guineas per set.
Sealed tenders, in the form attached to the specification, endorsed "Tender for Impounding Reservoir," to be forwarded to me on or before the 31st day of October next.
The Directors do not bind themselves to accept the lowest or any tender.
FREDERICK STORR, Secretary.
5, Charles Street, Wrexham, Sept. 21, 1874.

SWANSEA, GLAMORGANSHIRE.

IMPORTANT SALE OF SWANSEA GAS SHARES,
Under the powers of the Swansea Gas Act, 1861.

JOHN MACK LEEDER begs respectfully to announce that he has been favoured with instructions to SELL by public AUCTION, at the Mackworth Arms Hotel, Swansea, on Friday, Oct. 9, 1874 (subject to conditions of sale to be then produced, and in such lots as shall be determined on), 400 NEW SHARES, of £25 each, in the Swansea Gaslight Company.
These shares are issued under the authority contained in the 23rd section of the Swansea Gas Act, 1861, and are offered for sale by public auction in pursuance of the 24th section of that Act, and of a resolution passed at the general meeting of the Proprietors, held at Swansea, on the 17th of April, 1874.
The shares will be offered in such lots as to meet the convenience of all classes of investors, whose particular attention is respectfully directed by the Auctioneer to this safe and increasingly profitable property.
Sale to commence at half-past One for Two o'clock in the afternoon precisely.
Printed particulars may be obtained on application to CHARLES NORTON, Esq., Solicitor, Swansea; of the Secretary and Manager of the Company; or at the Auctioneer's Offices, Oxford Chambers, SWANSEA.

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THOMAS READ & CO.,
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MALTON, YORKS,
MANUFACTURERS OF
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PURCHASERS OF
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MANUFACTORY AND SHOW-ROOMS:
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ESTABLISHED 1807.
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TABLE GLASS OF ALL KINDS.
CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS

THE PATENT
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"The simplest machine of its kind."—*Engineering.*

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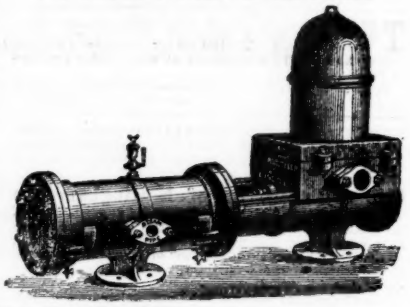
NO TAPPET VALVES OR GEAR.



IN USE IN SOME OF
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FOR
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One selected from amongst many Testimonials received by H. T. & Co.:—

"*Ardwick Bridge Chemical Works, Manchester, Oct.* 28, 1872.

"Sir,—The 'Universal' Steam Pump obtained from you, and which has been employed during the last six months pumping caustic soda at these works, still continues working satisfactorily.

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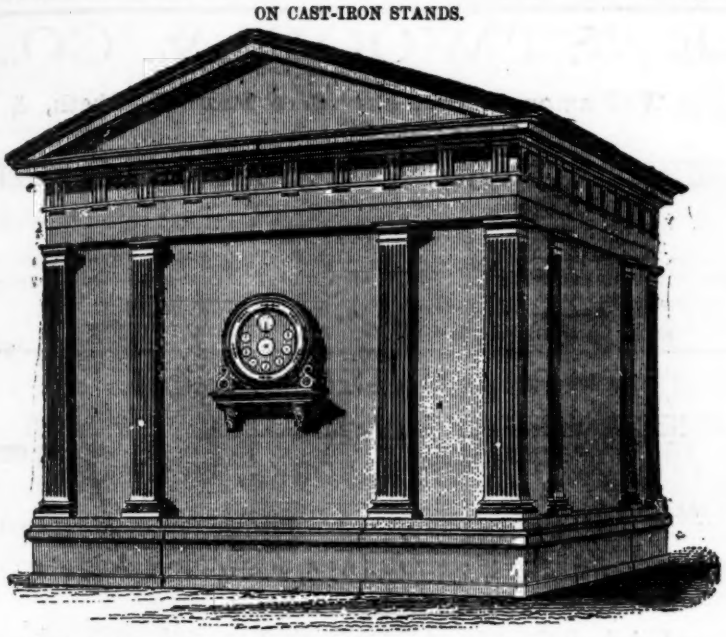

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WATER-METERS SUITABLE FOR ALL PRESSURES.

Home and Foreign Orders promptly attended to.

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Meter Works in London—2, CROSS STREET, WILDERNESS ROW, E.C.

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MR. ANDERSON advises Companies on all matters connected with the manufacture of Gas and the construction of Works.

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RETORT SETTINGS, heated by tar without the production of smoke.

STEAM-ENGINES and EXHAUSTERS, separately or combined.

FOUR-WAY VALVES, one of which is equal to three ordinary Valves.

STATION GOVERNORS—the Gasholder cannot tilt and cause accident.

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A Pamphlet containing Eighteen Illustrations of the foregoing, with letterpress on the construction of Works, post free, 2s. 6d.

N.B.—The second edition of this Work, *now ready*, contains Illustrations of the Machine for converting Breeze and Tar into Fuel for heating the Retorts.

"The Author is well qualified to speak authoritatively upon the important subjects to which his pamphlet refers."—*Artizan.*

THOMAS ALLAN & SONS, of Springbank Iron-Works, Glasgow, manufacture small cast-iron GAS AND WATER PIPES, 1¼ to 6 inches, at their branch works, Stockton-on-Tees, and have at present a large stock, which they are open to sell at moderate prices

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RICHARD THOMAS & CO.,

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Manufacturers of

EWELL FIRE-BRICKS, CLAY, AND CEMENT.

Warranted the best quality.

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CLAY RETORTS, FIRE-BRICKS, AND EVERY DESCRIPTION OF FIRE-CLAY GOODS

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MANUFACTURE EVERY DESCRIPTION OF

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INTERNATIONAL EXHIBITION, 1862.

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For excellence of Fire-Clay Gas Retorts, and "HONOURABLE MENTION" for good quality of Fire-Bricks.

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FIRE-BRICKS, GAS-RETORTS, & FIRE-CLAY GOODS of every description.

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CONTRACTORS for the PURCHASE of GAS TAR AND AMMONIACAL LIQUOR,

Also of their products.

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As supplied to the Imperial, Chartered, and other London and Provincial Gas Companies. Bellows and Valves for inflating Well Dresses, Stokers Gloves, India-Rubber Suction and Delivery Hose, Gas-Tubing, Leather India-Rubber and Gutta-Percha Machine-Bands, Sheet and Washers and Steam Joints.

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Can offer a CANNEL COAL yielding a large quantity of Gas of superior quality.
Prices and information on application to the HUCKNALL COLLIERY COMPANY, Hucknall Torkard Collieries, near NOTTINGHAM.

POPE & PEARSON'S GAS COAL.—We have now the authority of several of the most eminent Gas Engineers of London in stating that our Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.
One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.
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MAIN SEAM CANNEL COAL.
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Analysis and Price on Application.

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LIMITED,
COLLIERY PROPRIETORS,
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Supply the Best Wigan Arley Mine Gas Coal and Nuts; the Best Hand-picked Round Cannel;
ALSO SMALL OR GAS CANNEL, &c., &c.

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COAL OWNERS & MERCHANTS.
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From the Mines of the
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Yields 10,538 cubic feet of 33·2-candle gas, and nearly 11 cwt. of first-class coke. Same seam, geologically speaking, as the Lesmahago Main coal.
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FOR GAS-MAKING PURPOSES,
Yields 10,880 cubic feet of 16·1-candle gas, and fully 13 cwts. of first-class coke per ton.
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Yields 10,200 cubic feet of 14·9-candle gas, and fully 12 cwts. of first-class coke per ton.
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HYDRATED PEROXIDE OF IRON (BOG OCHRE),
Same quality as supplied by us to several of the most extensive Gas Companies, and which has given entire satisfaction.
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BIRTLEY IRON WORKS,
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Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.
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GENERAL CONTRACTORS & RETORT-SETTERS,
FITTERS & MAIN-LAYERS.
RETORTS SET ON THE LATEST IMPROVED PLAN.
Retort-Setters sent to all parts of Europe and America.
Address, J. and H. ROBUS,
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THE THAMES BANK IRON COMPANY,
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SUPPLY FROM STOCK
CAST-IRON RETORTS, SOCKET-PIPES for GAS or WATER PURPOSES, FLANGE-PIPES for STEAM, RAIN-WATER PIPES and GUTTERS, HOT-WATER PIPES and BOILERS, and all requisite Connexions for same; also LAMP-COLUMNS, LAMPS, WROUGHT FRAMES, WROUGHT-IRON TUBING, &c., &c.
All kinds of Gas-Works Apparatus and General Castings made to Pattern or Drawing.
ADDRESS—
OLD BARGE WHARF, UPPER GROUND STREET, LONDON, S.E.

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LIMITED,
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Canal Bridge Wharves, Old Kent Road, S.E.
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SHOEBURY AND KENT STOCKS, AND SUFFOLK RED AND WHITE BRICKS DELIVERED IN ANY QUANTITIES, OR BY BARGE ALONGSIDE.
Stourbridge, Newcastle, and Welsh FIRE-BRICKS and LUMPS of all descriptions.
Malam and Moulded Bricks, PORTLAND CEMENT (made from the Medway Earth, &c.) of UNSURPASSED quality.
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BUILDING GOODS OF ALL DESCRIPTIONS.

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GAS METER MANUFACTURERS, BRASSFOUNDERS & FINISHERS,
ATLAS METER-WORKS, OLDHAM.
CONSUMERS WET & DRY GAS-METERS ON THE MOST APPROVED PRINCIPLES.
STATION-METERS, GOVERNORS, PRESSURE-REGISTERS,
And every Description of Gas Apparatus.
GAS, STEAM, AND WATER FITTINGS.

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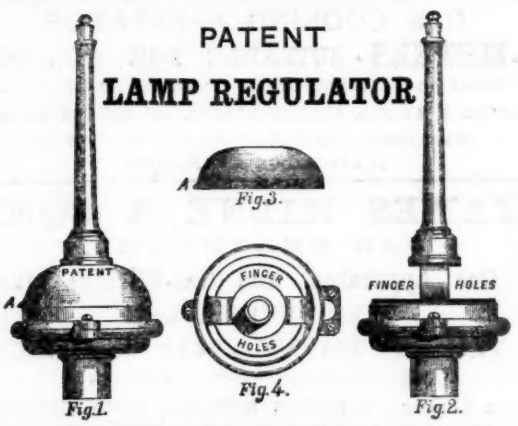
PATENT
LAMP REGULATOR


Fig.1. Fig.3. Fig.4. Fig.2.
D. BRUCE PEEBLES AND CO.,
ENGINEERS, WET AND DRY GAS-METER MANUFACTURERS,
PATENTEES OF
GAS REGULATORS FOR PUBLIC LAMPS, FACTORIES, PUBLIC HALLS, AND DWELLING-HOUSES.
Attention is respectfully requested to the following extract from a lecture "On the Economical Combustion of Coal Gas," delivered to the Philosophical Society of Glasgow, by Dr. W. Wallace, F.R.S.E., F.C.S., Gas Examiner for the city of Glasgow, on the 4th of March last:—
"A few years ago, a simple form of Gas Regulator for Street Lamps was introduced, I do not know by whom, and various forms of it, and improvements on it, have been made by many practical gas engineers. Of all the modifications of the instrument, the best in my opinion is that of Mr. D. Bruce Peebles, of Edinburgh; in fact, his Lamp Regulators are so superior that they are likely to supplant all others. Already about 9000 of these have been applied to the street-lamps in Glasgow, and I understand it is the intention of the authorities to introduce them all over the town. The saving thereby effected I calculate to be about £6000 per annum, without any diminution of light. One of the great advantages of Mr. Peebles's apparatus over all others is that it can be regulated while the gas is burning."
Since the above date, another 1000 have been supplied to Glasgow, and they are being largely adopted at home and abroad.
D. B. P. and Co. are prepared to Estimate for the Supply and Maintenance of their Regulators, and will be glad to forward terms on application.
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ENGINEERS, WET AND DRY GAS-METER MANUFACTURERS,
FOUNTAINBRIDGE WORKS, EDINBURGH.

G. J. EVESON,

GAS COAL MERCHANT,

STOURBRIDGE.

Delivery per Rail to any Part.

ROBERT DEMPSTER,

GAS ENGINEER AND CONTRACTOR,

ROSE MOUNT IRON-WORKS,

ELLAND, near HALIFAX,

MANUFACTURES AND EFFECTS

GAS APPARATUS & MACHINERY

OF EVERY DESCRIPTION.

GAS EXHAUSTERS,

WITH STEAM-ENGINES COMBINED.

DRY, CENTRE, AND BYE-PASS VALVES; WROUGHT-IRON AND CAST-IRON SCRUBBERS; ANNULAR AND PIPE CONDENSERS, ALL SIZES.

PURIFIERS from 4 to 40 FEET SQUARE.

Steam-Engines and Steam-Pumps.

RETORT SETTERS & FITTERS SENT TO ALL PARTS.

ALL WORK AND MATERIALS GUARANTEED OF THE BEST DESCRIPTION.

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COPPA COLLIERY, MOLD,

Beg leave to call the attention of Gas Companies to the superior quality of their

CANNEL FOR GAS-MAKING PURPOSES.

This Cannel produces in actual working, in iron retorts, 9200 cubic feet of 32-candle gas, and upwards of 11 cwt. of coke, and in clay retorts will produce 11,500 cubic feet of 25·9-candle gas.

Ports of shipment—Birkenhead or Connah's Quay.

Waggons supplied for delivery by railway to any part of England or Wales.

For particulars, prices, and rates of freight, apply to The Coppa Colliery, Mold, FLINTSHIRE.

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The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

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Established 1840.

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RUSSEL'S BOGHEAD.

MUIRKIRK, No. 1, CANNEL

Yields 11,600 cubic feet of 34·3-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

MUIRKIRK, No. 2, CANNEL

Yields 10,700 cubic feet of 32·77-candle gas per ton, and 9½ cwts. of coke, containing 11 per cent. of ash.

OLD WEMYSS CANNEL

Yields 12,550 cubic feet of 33-candle gas per ton.

Prices and full Analyses on application.

DUKINFIELD CANNEL COAL.

THE DUNKIRK COAL COMPANY.

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THORNCLIFFE IRON-WORKS AND COLLIERIES,

NEAR SHEFFIELD,

STRONGLY RECOMMEND A TRIAL OF THEIR

CELEBRATED SILKSTONE GAS NUTS.

Analysis by F. J. EVANS, Esq., Chartered Gas Company, Horseferry Road, Westminster:—

(COPY.)

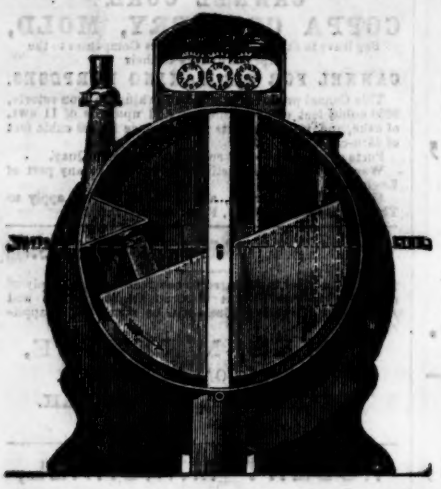
	Cubic Feet of Gas per Ton of Coal.	Illuminating Power in Candles.	Coke per Ton of Coal used.	Ash in Coke, per Cent.	Sulphur in Coal, per Cent.
Silkstone Nuts . . .	10·800	15·85	12·66 cwt.....	6·0	0·69

NOTE.—The illuminating power of the gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.

Horseferry Road, Westminster, March, 1870. (Signed) F. J. EVANS.

These Nuts are extensively used by various Gas Companies throughout the Kingdom, who bear strong testimony to their value.

APPLICATIONS FOR PRICES, &c., TO BE SENT DIRECT TO THE COLLIERY, AS ABOVE.



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UNVARYING WATER-LINE GAS-METER.

(SANDERS AND DONOVAN'S PATENT.)

"Unquestionably the best Water Gas-Meter now in use."—Thos. G. Barlow, C.E.

Over 90,000 in action.

MANUFACTURERS:

THE GAS-METER COMPANY,

KINGSLAND ROAD, LONDON;

WITH

Branch Manufactories at DUBLIN and OLDHAM.

1862.

PATENT ANTIMONY PAINT.

CLASS II.

MADE ONLY BY

GEORGE HALLETT & CO.,

296, ROTHERHITHE, LONDON, S.E.

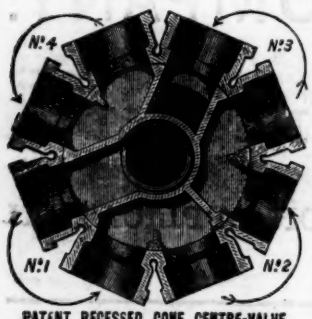
This Paint having been in general use over twelve years (especially in some of the principal Gas-Works), and proved itself the best light-coloured Paint produced for resisting the influence of vitiated atmospheres, it is important that its qualities should be more widely known.

It is not discoloured like white lead in a sulphuretted atmosphere, nor washed off like white zinc; and its light colour reflecting heat, produces much less expansion of gas in holders painted with it than with dark colours, besides rendering them much more sightly. Its specific gravity is so much below white lead that the same weight will cover one-third more surface, while it is equal in body; and its price being about the same (30s. per cwt.), it is actually one-third cheaper. From experience, its manufacture is greatly improved, and it is quite suitable for all purposes in which white lead is employed.

Reference is kindly permitted by the Engineers of the City of London, Commercial, London, and Surrey Consumers Gas Companies, who pronounce it the best Paint known for their purposes.

N.B.—Antimony Paint, COVERING SO MUCH MORE WORK, costs about 20s. per cwt., as compared with White Lead at 30s. per cwt.; a similar economy arises from its use in Steam and Gas Joints, for which purpose it is superior to White Lead.

SPECIAL DRIERS FOR ANTIMONY PAINT SUPPLIED.



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Sectional Plan.

R. LAIDLAW AND SON,

EDINBURGH AND GLASGOW,

SOLE MAKERS OF

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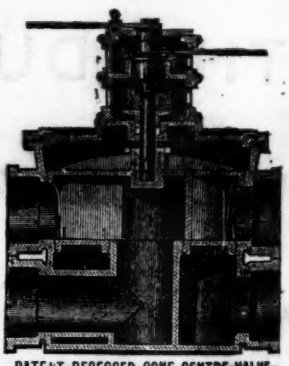
RECESSED CONE CENTRE-VALVES,

Constructed on the principle of the ordinary Plug-Cock.

THROUGH-WAY & FOUR-WAY COCKS

Of all descriptions.



PATENT RECESSED CONE CENTRE-VALVE.
Sectional Elevation.

LONDON OFFICE: 106, CANNON STREET.

D. HULETT and CO., 55 and 56, HIGH HOLBORN, LONDON,

PATENTEES and MANUFACTURERS of the ONLY GOOD MERCURIAL GAS REGULATOR

Invite the attention of Gas Companies and the Trade generally to their Improved GAS-METERS, which they warrant equal to any in Quality, Workmanship, and Simplicity of Construction, and the only Meters from which Gas cannot be obtained without being duly registered.

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GAS CHANDELIERS, GLASS LUSTRES, HALL LANTERNS, VESTIBULES, BRACKETS, PENDANTS;

DOUBLE CONE, ALBERT, SHADOWLESS, & EVERY DESCRIPTION OF BURNER, UNION JETS, BATSWINGS, ETC.;

IMPROVED FULL-WAY CARTER'S VALVES (much approved of);

GAS-STOVES, and every article connected with Gas Apparatus.

CAST & WROUGHT IRON PIPE, BLACK & GALVANIZED. COPPER, TIN, BRASS, & COMPOSITION TUBING.

D. HULETT'S IMPROVED SERVICE CLEANSER

for clearing out Mains, Services, and Interior Fittings—65s. net.

Boyle's Patent Silvered Glass Combination Reflectors and Outside Lanterns.

Sole Manufacturers of Church and Mann's Photometer.

Large Pattern-Books, with every description of Gas-Fittings, Chandeliers, &c., with complete Book of Prices, 12s.

London: Printed by William Boughton King (at the office of Clayton and Co., 17, Bouverie Street, Fleet Street); and published by him at No. 11, Bolt Court, Fleet Street in the City of London.—Tuesday, September 29, 1874.